SCIENCE

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INAUGURAL ADDRESS OF PRESIDENT BUTLER, OF COLUMBIA UNIVERSITY.

FOR these kindly and generous greetings I am profoundly grateful. To make adequate response to them is beyond my power. The words that have been spoken humble as well as inspire. They express a confidence and hopefulness which it will tax human capacity to the utmost to justify, while they picture a possible future for this University which fires the imagination and stirs the soul. We may truthfully say of Columbia, as Daniel Webster said of Massachusetts, that her past, at least, is secure; and we look into the future with high hope and happy augury.

To-day it would be pleasant to dwell upon the labors and the service of the splendid body of men and women, the University's teaching scholars, in whose keeping the honor and the glory of Columbia rest. Their learning, their devotion, and their skill call gratitude to the heart and words of praise to the lips. It would be pleasant, too, to think aloud of the procession of men which has gone out from Columbia's doors for well-nigh a century and a half to serve God and the State; and of those younger ones who are even now lighting the lamps of their lives at the altar-fires of eternal youth. Equally pleasant would it be to pause to tell those who

labor with us—North, South, East and West—and our nation's schools, higher and lower alike, how much they have taught us, and by what bonds of affection and fellow-service we are linked to them.

All these themes crowd the mind as we reflect upon the significance of the ideals which we are gathered to celebrate; for this is no personal function. The passing of position or power from one servant of the university to another is but an incident; the university itself is lasting, let us hope eternal. Its spirit and its life, its usefulness and its service, are the proper subjects for our contemplation to-day.

The shifting panorama of the centuries reveals three separate and underlying forces which shape and direct the higher civilization. Two of these have a spiritual character, and one appears to be, in part at least, economic, although clearer vision may one day show that they all spring from a common source. These three forces are the church, the state and science, or, better, scholarship. Many have been their interdependences and manifold their intertwinings. Now one, now another, seems uppermost. Charlemagne, Hildebrand, Darwin are central figures, each for his time. At one epoch these forces are in alliance, at another in opposition. Socrates died in prison, Bruno at the stake. Marcus Aurelius sat on an emperor's throne, and Thomas Aquinas ruled the mind of a universal church. All else is tributary to these three, and we grow in civilization as mankind comes to recognize the existence and the importance of each.

It is commonplace that in the earliest family community, church and state were one. The patriarch was both ruler and priest. There was neither division of labor nor separation of function. When development took place, church and state, while still substantially one, had distinct organs of expression. These often clashed, and the separation of the two principles was thereby hastened. As yet scholarship had hardly any representatives. When they did begin to appear, when science and philosophy took their rise, they were often prophets without honor, either within or without their own country, and were either misunderstood or persecuted by church and state alike. But the time came when scholarship, truth-seeking for its own sake, had so far justified itself that both church and state united to give it permanent organization and a visible body. This organization and body was the university. For nearly ten centuries—a period longer than the history of parliamentary government or of Protestantism—the university has existed to embody the spirit of scholarship. Its arms have been extended to every science and to all letters. It has known periods of doubt, of weakness and of obscurantism; but the spirit which gave it life has persisted and has overcome every obstacle. To-day, in the opening century, the university proudly asserts itself in every civilized land, not least in our own, as the bearer of a tradition and the servant of an ideal without which life would be barren and the two remaining principles which underlie civilization robbed of half their power. To destroy the university would be to turn back the hands upon the dial of history for centuries; to cripple it is to put shackles upon every forward movement that we prize—research, industry, commerce, the liberal and practical arts and sciences. To support and enhance it is to set free new and vitalizing energy in every field of human endeavor. Scholarship has shown the world that knowledge is convertible into comfort, prosperity and success, as well as into new and higher types of social order and of spirituality. 'Take fast hold of instruction,' said the wise man; 'let her not go; keep her; for she is thy life.'

Man's conception of what is most worth knowing and reflecting upon, of what may best compel his scholarly energies, has changed greatly with the years. His earliest impressions were of his own insignificance and of the stupendous powers and forces by which he was surrounded and ruled. The heavenly fires, the storm-cloud and the thunderbolt, the rush of waters and the change of seasons, all filled him with an awe which straightway saw in them manifestations of the superhuman and the divine. Man was absorbed in nature, a mythical and legendary nature, to be sure, but still the nature out of which science was one day to arise. Then at the call of Socrates, he turned his back on nature and sought to know himself, to learn the secrets of those mysterious and hidden processes by which he felt and thought and acted. The intellectual center of gravity had passed from nature to man. From that day to this the goal of scholarship has been the understanding of both nature and man, the uniting of them in one scheme or plan of knowledge, and the explaining of them as the offspring of the omnipotent activity of a creative spirit, the Christian God. Slow and painful have been the steps toward the goal, which to St. Augustine seemed so near at hand, but which has receded through the intervening centuries as problems grew more complex and as the processes of inquiry became so refined that whole worlds of new and unsuspected facts revealed themselves. Scholars divided into two camps. The one would have ultimate and complete explanations at any cost; the other, overcome by the greatness of the undertaking, held that no explanation in a large and general way was possible. The one camp bred sciolism; the other narrow and helpless specialization.

At this point the modern university problem took its rise; and for over 400 years the university has been striving to adjust its organization so that it may most effectively bend its energies to the solution of the problem as it is. For this purpose the university's scholars have unconsciously divided themselves into three types or classes—those who investigate and break new ground; those who explain, apply, and make understandable the fruits of new investigation; and those philosophically minded teachers who relate the new to the old, and, without dogma or intolerance, point to the lessons taught by the developing human spirit from its first blind gropings toward the light on the uplands of Asia or by the shores of the Mediterranean, through the insights of the world's great poets, artists, scientists, philosophers, statesmen and priests, to its highly organized institutional and intellectual life of to-day. The purpose of scholarly activity requires for its accomplishment men of each of these three types. They are allies, not enemies; and happy the age, the people, or the university in which all three are well represented. It is for this reason that the university which does not strive to widen the boundaries of human knowledge, to tell the story of the new in terms that those familiar with the old can understand, and to put before its students a philosophical interpretation of historic civilization, is, I think, falling short of the demands which both society and university ideals themselves may fairly make.

Again a group of distinguished scholars in separate and narrow fields can no more constitute a university than a bundle of admirably developed nerves without a brain and spinal cord can produce all the activities of the human organism. It may be said, I think, of the unrelated and unexplained specialist, as Matthew Arnold said of the Puritan, that he is in great danger; because he imagines himself in possession of a rule telling him the *unum necessarium*, or one thing needful, and that

he then remains satisfied with a very crude conception of what this rule really is, and what it tells him, and in this dangerous state of assurance and self-satisfaction proceeds to give full swing to a number of the instincts of his ordinary self. And these instincts, since he is but human, are toward a general view of the world from the very narrow and isolated spot on which he stands. Only the largest and bravest spirits can become great specialists in scholarship and resist this instinctive tendency to hasty and crude philosophizing. The true scholar is one who has been brought to see the full meaning of the words development and history. He must, in other words, be a free man as Aristotle understood the term. The free man is he who has a largeness of view which is unmistakable and which permits him to see the other side; a knowledge of the course of man's intellectual history and its meaning; a grasp of principles and a standard for judging them; the power and habit of reflection firmly established; a fine feeling for moral and intellectual distinctions; and the kindliness of spirit and nobility of purpose which are the support of genuine character. On this foundation highly specialized knowledge is scholarship; on a foundation of mere skill, deftness or erudition, it is not. The university is concerned with the promotion of the true scholarship. It asks it in its scholars who teach; it inculcates it in its scholars who learn. It believes that the languages, the literatures, the art, the science and the institutions of those historic peoples who have successively occupied the center of the stage on which the great human drama is being acted out, are full of significance for the world of to-day; and it asks that those students who come to it to be led into special fields of inquiry, of professional study or of practical application, shall have come to know something of all this in an earlier period of general and liberal studies.

Mr. Emerson's oration before the oldest American society of scholars, made nearly sixty-five years ago, is the magnetic pole toward which all other discussions of scholarship must inevitably point. His superb apology for scholarship and for the scholar as Man Thinking opened an era in our nation's intellectual life. The scholar as Mr. Emerson drew him is not oppressed by nature or averse from it, for he knows it as the opposite of his soul, answering to it part for part. He is not weighted down by books or by the views which Cicero, which Locke, which Bacon have given, for he knows that they were young men like himself when they wrote their books and gave their views. He is not a recluse or unfit for practical work, because he knows that every opportunity for action passed by is a loss of power. The scholar, in short, as the university views him, and aims to conserve and to produce him and his type, is a free man, thinking and acting in the light of the world's knowledge and guided by its highest ideals.

In this sense the university is the organ of scholarship, and in this sense it aims to be its embodiment. The place of scholarship has been long since won, and is more widely recognized and acknowledged than ever before. The church and the state, which first gave it independence, are in close alliance with it and it with them. The three are uniting in the effort to produce a reverent, well-ordered and thoughtful democratic civilization in which the eternal standards of righteousness and truth will increasingly prevail.

But a university is not for scholarship alone. In these modern days the university is not apart from the activities of the world, but in them and of them. It deals with real problems, and it relates itself to life as it is. The university is for both scholarship and service; and herein lies that ethical equality which makes the uni-

versity a real person, bound by its very nature to the service of others. To fulfil its high calling the university must give, and give freely, to its students, to the world of learning and of scholarship, to the development of trade, commerce and industry, to the community in which it has its home, and to the state and nation whose foster-child it is. A university's capacity for service is the rightful measure of its importunity. The university's service is today far greater, far more expensive, and in ways far more numerous than ever before. It has only lately learned to serve, and hence is has only lately learned the possibilities that lie open before it. Every legitimate demand for guidance, for leadership, for expert knowledge, for trained skill, for personal services, it is the bounden duty of the university to meet. It may not urge that it is too busy accumulating stores of learning and teaching students. Serve it must, as well as accumulate and teach, upon pain of loss of moral power and impairment of usefulness. At every call it must show that it is

> Strong for service still and unimpaired.

The time-old troubles of town and gown are relics of an academic aloofness which was never desirable and which is no longer possible.

In order to prepare itself for efficient service the university must count in its ranks men competent to be the intellectual and spiritual leaders of the nation and competent to train others for leadership. Great personalities make great universities. And great personalities must be left free to grow and express themselves, each in his own way, if they are to reach a maximum of efficiency.

Spiritual life is subject neither to mathematical rule nor to chemical analysis. Rational freedom is the goal towards which the human spirit moves, slowly but irresistibly, as the solar system towards a point in the constellation Hercules; and national freedom is the best method for its movement. Moreover, different subjects in the field of knowledge and its applications require different approach and different treatment. It is the business of the university to foster each and all. It gives its powerful support to the learned professions, whose traditional number has of late been added to by architecture, engineering and teaching, all of which are closely interwoven with the welfare of the community. It urges forward its investigators in every department and rewards their achievements with the academic laurel. It studies the conditions under which school and college education may best be given, and it takes active part in advancing them. In particular, it guards the priceless treasure of that liberal learning which I have described as underlying all true scholarship, and gives to it full-hearted care and protection. These are all acts of service direct and powerful.

The university does still more. It lends its members for expert and helpful service to nation, state, and city. University men are rapidly mobilized for diplomatic service, for the negotiation of important treaties, for the administration of dependencies, for special and confidential service to the Government, or some department of it, and, the task done, they return quietly to the ranks of teaching scholars, as the soldiers in the armies of the war between the States went back to civil life without delay or friction. These same university men are found foremost in the ranks of good citizenship everywhere and as laymen in the service of the Church. They carry hither and yon their practical idealism, their disciplined minds, and their full information, and no human interest is without their helpful and supporting strength. It is in ways like these that the

university has shown, a thousand times, that sound theory and correct practice are two sides of a shield. A theorist is one who sees, and the practical man must be in touch with theory if he is to see what it is that he does.

What the future development of the great universities is to be perhaps no one can foresee. But this much is certain. Every city which because of its size or wealth or position aims to be a center of enlightenment and a true world-capital must be the home of a great university. Here students and teachers will throng by the mere force of intellectual gravitation, and here service will abound from the mere host of opportunities. The city, not in its corporate capacity, but as a spiritual entity, will be the main support of the university, and the university, in turn, will be the chief servant of the city's higher life. True citizens will vie with each other in strengthening the university for scholarship and for service. In doing so they can say, with Horace, that they have builded themselves monuments more lasting than bronze and loftier than the pyramids reared by kings, monuments which neither flood nor storm nor the long flight of years can overthrow or destroy. Sir John de Balliol, doing a penance fixed by the Abbot of Durham; Walter de Merton, making over his minor house and estates to secure to others the advantages which he had not himself enjoyed; William of Wykeham, caring generously for New College and for Winchester school; John Harvard, leaving half his property and his library to the infant college by the Charles, and Elihu Yale, giving money and his books to the collegiate school in New Haven, have written their names on the roll of the immortals and have conferred untold benefits upon the human race. Who were their wealthy, powerful, and high-born contemporaries? Where are they in the grateful esteem of the generations that have come after them? What service have they made possible? What now avails their wealth, their power, their high birth? Balliol, Merton, Harvard, Yale are names known wherever the English language is spoken, and beyond. They signify high purpose, zeal for learning, opposition to philistinism and ignorance. They are closely interwoven with the social, the religious, the political, the literary history of our race. Where else are there monuments such as theirs?

Scholarship and service are the true university's ideal. The university of today is not the 'home of lost causes, and forsaken beliefs, and unpopular names, and impossible loyalties.' It keeps step with the march of progress, widens its sympathies with growing knowledge, and among a democratic people seeks only to instruct, to uplift and to serve, in order that the cause of religion and learning, and of human freedom and opportunity, may be continually advanced from century to century and from age to age.

TYPES AND SYNONYMS.

From the literary standpoint the existence of many names for the same or closely similar objects or ideas is thought to enrich language and to conduce to facility, elegance and accuracy of expression. In systematic biology, however, synonyms figure as superfluous designations which furnish no useful or welcome additions to the vocabulary of science; biological synonymy is a most burdensome legacy of ignorance and confusion, requiring constant revision and readjustment, and yielding no adequate returns for the labor which the naturalist must expend in historical or merely antiquarian research. Indeed, the study of systematic biology appears to be little more than a 'battle of the synonyms' when its most conspicuous

result is the replacement of long-used names by others whose tenure is guaranteed only by personal opinions and individual methods of literary and historical criticism.

It is true that several independent descriptions of the same animal or plant often furnish more complete and satisfactory knowledge than could have been expected from any one naturalist, but not even this consideration will reconcile us to the indefinite multiplication of names by those more anxious to announce discoveries than to contribute to the permanent progress of scientific knowledge. As in general literature, it may sometimes be permissible to coin new scientific terms to avoid the confusion likely to arise from the use of those of doubtful application, but the tendency for the last half century has been distinctly in the direction of a divorce of systematic from general literature by holding to the permanent use of old names in preference to the admission of new and improved designations, the substitution of which had previously been a very common practice.

INSTABILITY UNDER LITERARY METHODS.

In dealing with specific names both zoologists and botanists now recognize that nomenclatorial stability requires adherence to a definite law of priority, with a fixed initial date and other regulations necessary for securing uniform interpretation and eliminating the variable factor of individual opinion. The wisdom and utility of these laws are now generally considered obvious, although there were many objections at first, and even the great Bentham took the ground that as the names of plants consist of two parts, a law of priority could be applied only to 'correct combinations.' By a similar effort of casuistry an effective priority for genera is now held to be impossible by systematists who still work under the theory that we are not attempting to name the natural groups of plants and animals, but are merely attaching names to varying concepts and definitions, the applications of which are to be determined by a historical study of the various interpretations and arguments of previous students. Some counsel a strict adherence to the intention of the original author, while others are accustomed to accept the usage of subsequent writers, so that it not infrequently happens that a name is used for a group of species quite distinct from those at first placed under it. An instance of this kind is that of the royal palm,* where the failure to hold the names *Euterpe* and *Oreodoxa* to their original species has complicated the synonymy and distribution of at least six genera.

Such usage accords well with the literary vicissitudes of words and definitions, but it is obviously not likely to conduce to the precision and stability required in scientific terms. The method of elimination, under which interpretations of genera are limited by the original content of

* Already noted in SCIENCE, N. S., 12:479, and in *The Bulletin of the Torrey Botanical Club*, 28:549.

The name *Oreodoxa* was originated by Willdenow for two Venezuelan species, the first of which, *O. acuminata*, has been referred to the older genus *Euterpe* while the second, *O. praemorsa*, has been used by Wendland as the basis of his genus *Catoblastus*, the name *Oreodoxa* being transferred to still a third group, no species of which was known to the author of *Oreodoxa*. The extent of the carelessness induced by the method of concepts is further illustrated by the fact that the genus *Euterpe*, to which *Oreodoxa acuminata*, and numerous other American species have been referred by many eminent botanists, was not established for an American palm, but for an East Indian species described by Rumphius as a *Pinanga* in 1741, and renamed *Calyptrocalyx* by Blume in 1836. Gaertner's original use of the name *Euterpe* in 1788 was however also connected with seeds of still another old-world palm not yet identified.

species, was an important step in advance of general literary chaos, though still far from logical accord with the principles of evolution and synthetic classification. From the practical standpoint also it is seriously objectionable as being but a partial measure which perpetuates and legalizes, even if in somewhat limited form, the very confusion it was desired to end.

Under the Benthamian method or 'Kew Rule' a plant might have a different specific name in each of the several genera to which different systematists might refer it, and under the so-called 'method of elimination' a generic name may be applied to several entirely different groups of species, as a result of varying theories of classification. But however inadequate for bringing about uniformity and stability of nomenclatorial practice, these propositions are of interest as admissions of the desirability of a formulated procedure instead of unguided personal caprice.

It may be charged equally against these methods, as well as against the method of types, that the authors of the older genera did not expect their writings to be interpreted by such criteria, since all three propositions have resulted from the recognition of the fact that the tasks of systematic biology are very different from the anticipations of the eighteenth century naturalists. With the prospect of a few thousand genera to be dealt with, the matter of a few synonyms for each was not important, and each naturalist might hope for the general acceptance of his improved names and descriptions. But with strengthening indications that a million genera or more will be needed to present the complexities of organic nature, sentiments of literary liberty may well give way to measures promising the practical advantages of uniformity and stability.

Moreover, where carelessness and caprice have been the rule the application of any system must be expected to result in many changes from current usage. And if the followers of the system of elimination have not hesitated to set aside many names in universal use for others discovered only by antiquarian research and supported only by individual theories of historical and literary interpretations, how much less should they object to changes made in accordance with the requirements of a method which can end, instead of merely diminishing, the instability admitted by all to be a most serious hindrance to the progress of systematic biology?*

* While this paper has been waiting for the press the type question has broken out among the spiders, a group rendered nomenclatorially difficult because many of the older generic names were proposed in connection with numerous species. Mr. F. Pickard Cambridge concludes (*Annals Mag. Nat. Hist.* (7), VIII., p. 403, Nov., 1901), after a spirited discussion with the German arachnologist, Professor Dahl, that definite types are a necessity in generic nomenclature, and that the method of elimination will not yield stability either in theory or in practice.

"Now elimination pure and simple in its practical application almost invariably lands us in an absurdity. In this way, the species which the authors withdraw are usually those that are best known, with characters salient and well described, leaving in those less well known, with this result, that the last species left in is one which is not known, is badly described, and never likely to be identified with any certainty; and this miserable phantom is left us as the type of the genus."

As a means by which this objection may be partially avoided it is proposed that when a generic name has had a specific type assigned for it the question should not be reopened, but it becomes at once apparent that the determination of the fact of such assignment would itself be a question on which differences of opinion might be entertained, so that Mr. Cambridge is brought to the further suggestion that such a designation be accepted only when the word *typ, typus* or *type* is used, and would rule out *exemplum, exemple* and *example,* also, presumably, *original, original species, chef de file* and other linguistic and verbal differences of expression of the same idea. On the other hand, no notice is taken of the complications possible through the fact that the word type

NOMENCLATURE APART FROM CLASSIFICATION.

Another of the many sources of confusion attending literary methods of dealing with systematic writings appears in connection with the citation of authors of generic names. After the abandonment of the practice of renaming each newly adjusted concept it became customary to refer generic names, not to their original authors, but to those who had made the last or most improved emendation of the definition. With such excellent opportunities some biological highwaymen did not hesitate to appropriate for themselves the entire nomenclature of their specialties, and evidently thought that by introducing changes in the generic descriptions they would establish claims to permanent recognition. Adherence to the idea that a genus is a group of species, and not merely a concept, and that the generic name is to be attached to a species rather than to a definition, affords an effective remedy for all difficulties arising from emendations, *pro parte* references and similar complications. The generic name when firmly anchored to a type species is no longer affected by vicissitudes of opinion among systematists, and in an important practical sense the problems of nomenclature are made to stand apart from those of classification and expression.

Groups recognized as genera by some authors will not be so treated by others, but genera, however constituted, will uniformly bear the oldest name which was first applied to any of their component spe-

has been largely used, even in systematic writings, in a phylogenetic rather than in a nomenclatorial sense.

The relief afforded by this amendment is moreover very slight, as shown in a subsequent paper which undertakes the actual work of 'A Revision of the Genera of the Araneæ or Spiders with reference to their Type Species' (*ibid.*, 7, ser. IX., p. 5, Jan., 1902), and the essential instability of the process of securing types through elimination and 'implication' is recognized and frankly admitted.

"Of course an author has a perfect right to include any species he likes, and must face the consequences if the last species left in his group by subsequent withdrawals turns out to be congeneric with the type of some earlier genus, whereby he loses his name as a synonym. The process * * * leads to great confusion, for it may afterward be urged * * * that the species removed was not congeneric with the earlier genus * * * By this renewed claim * * * the equilibrium is upset all along the line, and down come a score perhaps of generic ninepins whose stability depended upon the validity of this first step. It is not possible of course to avoid this tragedy of the ninepins so well known to and so justly feared by everyone who has endeavored to fix genera upon solid ground * * * there is always the possibility that it may turn out that the two species were after all not identical, and down come several ninepins, and the whole position has to be reconsidered. We have thus to recognize and face this possibility. What we want to do however is to avoid as much as possible any steps of elimination which might court such a catastrophe."

As an example the genus *Neriene* is cited, which would become a synonym of *Linyphia* if, as some think, the last species, *N. marginata*, is congeneric with the type of that genus. Those who hold this view would however maintain that *Neriene cornuta* should serve as the type and would thus unseat the name *Dicyphus*, in which alternations 'other subsequent genera will be involved, and so on to distraction.'

That this condition is not chronic among systematists who defend the method of elimination is due to the fact that they use it with 'discretion,' as an eminent zoologist once informed me, and do not attempt any general or constant application of it to such a task as Mr. Cambridge has undertaken. Those who prefer their ninepins under the guise of nomenclature have but to hold fast to the beautifully absurd rule quoted with approval by both Messrs. Dahl and Cambridge.

"The first publication in which a genus is subdivided, whether justifiably or unjustifiably, whether in a conscious or unconscious manner, must, where no typical form was named, decide what portion of the original genus is to retain the original name."

cies, and a generic name, whenever and wherever used, will have a fixed point of attachment to nature. Progress in the science of systematic biology must still compel endless modifications of the supposed limits of genera, but the method of types affords a complete and ideal solution of all the attendant difficulties which can be correctly assigned to the province of nomenclature. By the simple expedient of treating a generic name as inseparably attached to its original species as its nomenclatorial type, the whole maze of definitions, history, casuistry, confusion and contention is resolved into definite elements capable of rational and permanent adjustment. Of two or more generic names established on the same species only the oldest should be used, no matter how much the original definitions may have differed, while genera founded on species belonging to distinct natural groups will never be the same, no matter how closely the definitions may have approximated.

HOMONYMS.

The adjustment of the claims of competing generic propositions by reference to types rather than to concepts has many practical advantages. It becomes, for example, more obvious than before that generic synonyms are of several kinds, the nomenclatorial standings of which are very different. The first recognition of such distinctions is to be found in the so-called 'law of homonyms,' to the effect that the same name should be used only once in the plant or animal series. It has been held by some systematists that a homonym or second use of the same name might hold where the first had for any reason miscarried, but the impossibility of establishing the fate of any particular name under the method of concepts and elimination has rendered it obviously unwise to risk the confusion attendant on a resurrection of the supposedly defunct older genus, and the rule or principle 'once a synonym always a synonym' is receiving general recognition. And yet this aphorism is very misleading, since all synonyms are not homonyms, and the restoration of other kinds of synonyms is a very common occurrence. 'Once a homonym always a homonym' or 'once a homonym always a synonym' would be a much more correct statement, though in these forms the idea becomes a mere truism.

TYPONYMS.

Another class of synonyms hopelessly invalid from the beginning is the typonym, a generic name based on a species which has already been used as the type of a genus. Even in dealing with a genus containing but a single species variety in definitions has often led systematists to continue the multiplication of names. Thus although Rostafinski found that the names *Strongylium fuliginoides, Dermodium inquinans* and *Lachnobolus cribrosus* had all been used for a single species of Myxomycetes, which he treated as representing a monotypic genus, he again redefined the same genus and rechristened it with a fourth name. The only possibility of resurrection for a typonym is in the event of the previous name being found to be a homonym, as in the present instance where *Strongylium* was preoccupied for a lichen, so that the correct name for the Rostafinskian genus *Amaurochætæ* appears to be *Dermodium*.*

* The binomial *Dermodium atrum* (A. & S.) would have been used by Rostafinski if the principle of priority had been observed, in spite of the fact that *Dermodium* is usually treated as a synonym of the unrelated genus *Lycogala*. Neither can the name *Lachnobolus* be used in the sense in which Rostafinski and subsequent writers have employed it, since it was originally established as monotypic and included only *L. cribrosus* as above. Fries had already in 1849 applied the name *Nassula* to the species which

The present use of the word typonym, though somewhat different, does not necessarily conflict with that in which it has been employed by Dr. Gill* for names founded on types instead of on descriptions, since under the method of types, which requires that all genera be connected with species, this distinction regarding typonyms is no longer important. Although objecting to the naming of genera on types and without diagnoses Dr. Gill well says: "Certainly it is more rational to use a typonym than to require a definition for show rather than use." As a matter of fact the great majority of the older generic definitions are of little use or taxonomic value except for historical purposes, and it is a great practical advantage to be able to gain an idea of a genus from specimens, figures or detailed descriptions of a type species instead of being limited to the reconstruction of concepts based, too often, on slight knowledge and careless record. Moreover, as all systematists know, it is quite possible for many of their number to write long acounts of genera without betraying any facts of diagnostic importance, a point to receive further attention below.

METONYMS.

Synonyms of the third class, which may be called metonyms, differ from typonyms in not being based on the same types as the older names with which they are held to be synonymous, and unlike homonyms and typonyms, they may often be restored to active use, even after long periods of retirement. Improvement in the systematic treatment of many groups has been extremely slow, and even periods of reaction are sometimes encountered. Some biologists are as far ahead as others are behind the times, and there have been numerous instances where taxonomic work of high quality has remained unheeded for many decades, or until general progress had reached the plane where the genius of its author could be appreciated. Strangely enough, some botanists who hold to liberty of literary and historical interpretation and deprecate legislation in the interest of uniformity, have given their support to the rather barbarous proposition that systematic study which is not accepted by somebody inside of fifty years becomes outlawed. The desire to wipe away old scores of casuistry and confusion can be readily understood, but that to do this it should be thought necessary to place a premium upon reaction and ignorance has brought the ultra-literary botanists within easy range, it would seem, of an appreciation of the absurdity of their own position.

The complications for which the 'Berlin Rule' of a fifty-year limit gives partial relief are much more thoroughly obviated under the method of types, and that without discriminating against conspicuous ability and advanced ideas, and without requiring the discoverers of rare plants and animals to see that their genera are re-

Rostafinski treated under *Lachnobolus globosus* in 1875. More recently Lister has carried the confusion a step further by relegating *L. globosus* back to *Arcyria* while retaining the name *Lachnobolus* for still a third generic group represented by *L. cinoinans* Fries, for which no correct generic name exists.

Lister is also in error in citing Fries, 1835 (Fl. Scand., 356), as the original reference for the genus *Lachnobolus*, which was published ten years before (Sys. Orb. Veg., 1: 148), with *L. cribrosus* as the only species. Lister's suggestion (Mon. Mycetozoa, 112) that *Lachnobolus cribrosus* Fries may have been a confluent form of *Stemonitis splendens* does not furnish a justification for the use of the generic name in a different family. The genus called *Lachnobolus* by Lister, which differs from *Arcyria* in having the sporangia sessile and the wall persistent, must be renamed, and may be called *Arcyodes*, the type being *A. incarnata* (*Licea incarnata* Albertini & Schweinitz, Consp. Fung., 109, 1805).

* *Proc. A. A. A. S.*, 45: 155, 1896.

published every half century in order to prevent the loss of copyright privileges and scientific honors to an ungracious posterity.

HYPONYMS.

A generic hyponym is a name not used because inadequately published—that is, not printed in connection with a recognized species. Again will the consistently literary botanist insist that the earlier writers studied and described their genera quite apart from species, and that it is an empirical and revolutionary proposition which would set aside tradition and usage and insist upon the arbitrary requirement of a generic type. This, however, is but an obvious corollary of the taxonomic principle that genera should not be studied and named as concepts, but as groups of species. Moreover, the regulation which it has been sought to enforce under the method of concepts, that a generic name must be accepted which was accompanied by anything whatever in the way of description, is equally arbitrary and has a fatal lack of practical utility, since most of the older descriptions are utterly inadequate for diagnosis under modern classification. That the generic descriptions had come to be recognized as a mere formality which could even be entirely dispensed with, was well shown, quite apart from the method of types, by the selection of the 'Species Plantarum' of Linnæus as the initial work of reference for botanical nomenclature. This book contains no descriptions of genera, but it was very properly held that the genera could be much more satisfactorily inferred from the species than from the descriptions given in Linnæus' 'Genera Plantarum.'

Some naturalists who have appreciated the hollowness of the idea that a mere series of words must be taken as establishing a generic name in full nomenclatorial standing, are inclined to insist that genera must really be described so as to in some measure approximate modern ideas, even though this would require the abandonment of many well-known names of the large composite genera of the older authors. However logical this procedure may be, the general application of it could only result in increased confusion, since there is not the smallest probability of agreement among naturalists as to *how much* of a description is necessary to the diagnosis of any particular genus or other natural group.

The formal requirement of a description for a species has a far more logical justification. An identifiable species locates at once one point in a genus, but subsequent students may have no clue to an uncharacterized species. It is thus a matter of expediency as well as of right to reject specific names not accompanied by descriptions, though such a practice will lead to confusion unless it be applied only to actual *nomina nuda;* far too many changes and disagreements would appear if the question of the adequacy of specific descriptions were to be raised. Practical legislation must, of necessity, converge upon technical points, and the utility of any enactment depends upon reducing the number and making plain the location of these foci. Biologically a genus is generally a group of species, but nomenclatorially it may always be narrowed to a single species, and under a binomial system to a single binomial species, which must have nomenclatorial status before it can be made the basis of a nomenclatorially valid generic name.

The limitation of taxonomic recognition to generic names established in connection with identifiable binomial species would be a most useful regulation since it would dismiss to final oblivion a large number of still-born names which for a century or more were passed over by botanists, but

which the injudicious zeal of recent reformers has resurrected and attempted to galvanize to the life of modern taxonomy. The Rochester Rules were avowedly drawn to enact a law of priority under the binomial system of nomenclature, although, to give a definite point of departure, it was agreed to disregard the hundreds of binomials published before 1753. Every principle of logic and every practical consideration would have led us to expect the acceptance of the obvious corollary of that proposition—the rejection of the non-binomial literature published after that date. This simple distinction having been neglected, we have only the no longer logical but purely arbitrary 1753 rule to keep us from the older polynomial literature, to say nothing of the many pre-Linnæan books in which binomials were used. The process of restoring Adanson's names is only just begun in dealing with the botany of North America. There are pages and pages of the closely printed lists of the 'Familles' as yet not drawn upon by our antiquarian friends, but the zest with which they have delved in this débris only shows what would be their delight in first-class cemeteries like Micheli and Tournefort, if indeed they would remain content with these and not insist on pushing back to a more obscure antiquity. Seriously, however, the reinstatement of these Adansonian and similarly unattached and long-forgotten names is an utterly needless imposition contrary to the spirit in which the reform attempted at Rochester and Springfield was encouraged and supported by the botanical public.

CACONYMS.

This necessity of some provision for the more definite limitation of taxonomic literature on the sides of Latinity, brevity and binomiality can be made even more obvious by reference to a neglected contribution to the botany of Mexico, the work of Francisco Hernandez: 'De Historia Plantarum Novæ Hispaniæ.' This was published in Madrid in 1790 from manuscripts written in the sixteenth century. It records names for toward a thousand genera of Mexican plants and antedates a large part of the current systematic botany of that and the neighboring regions. The three quarto volumes contain a total of 1,611 pages, and are written in Latin throughout, with the adoption of the Aztec names which stand either alone or in the form of binomials. Thus the first chapter is headed: 'De Apitzalpatli crenata, seu de herba secta per ambitum fluxum alvi cohibente.' Then follow 'Apitzalpatli altera, Apitzalpatli Uyauhtepecensi, Apitzalpatli Tehoitztlac, Apitzalpatli Teuhaltzincensi,' and others equally unmanageable by the tongues of European peoples, though differing only in degree from Thlaspi, Gajati, Alhagi, Tsubaki, Tsjinkin, Hombak, Sinapi, Gansblum, Konig, Korosvel, Canschi, Malagu, Coddampulli, Mangostan, Japarandi, Celeri, Chocho, Mokos, Agialid, Tsususi, and hundreds of others which have not prevented the recent resurrection of the taxonomy of Adanson's 'Familles,' in spite of the fact that it had been almost universally ignored for upward of a century. An objection might be taken to the specific names of Hernandez because his work is not consistently bionomial, but the fact that he so frequently uses names of that form would seem to give his generic designations a better claim to recognition than those of the strictly monomial Adanson, or those of the numerous polynomial post-Linnæan writers like Haller. But however effective such reasoning might be if Apitzalpatli stood alone or with a few similar terms, the fiercest Adansonians may well quail before what Hernandez was able to transcribe after he had acquired more fluency in Aztec: Tlalaxixquilitl, Tlalte-

comaxochitl, Tlalacxouatl, Atonahuizpatli, Tlatlauhquichicomacatl, Yztacchacomacatl, Copalquahuitlpatlahoac, Tlahoelilocaquahuitl, Tzinacancuitlaquahuitl, Yztacpatlichichipiltic and Chichictlapalezquahuitl. Even Hernandez seems to have had a suspicion that some of these names were too long to meet with general popularity outside of Mexico, for in several instances he suggested more manageable abbreviations. Thus chapters are not infrequently headed like the following: 'De Chichictzompotonic, seu Tzompotonic amara'; 'De Cozticcoanenepilli, seu Coanenepilli lutea'; 'De Yztacquahxiotl, seu Quauhxiotl alba'; 'De Tecopalquahuitl, seu Copalli montana.'

But the second generic names, though shorter, are no more Latin than the first, and the practice of determining priority by position would prevent their being taken up in preference to the preceding unmodified designations.

From the standpoint of some taxonomists the forms of names appear of merely incidental importance, and the tendency of recent years has been toward the acceptance of the oldest designation, no matter how inappropriate, incorrect, barbarous or foolishly long it might be. Hybrids formed by the compounding of Greek with Latin roots, though a frequent cause of protest from biologists of classical training and sensibility, are really among the lesser difficulties, and a partial defense of them is to be found in the fact that, although the language of systematic biology is Latin, it has continued and extended the custom of the Romans in drawing freely from the richer and more convenient Greek vocabulary available for the formation of scientific terms. But there are practical as well as merely literary difficulties in connection with unreasonable names, and while some of these can be excluded on other grounds than those of form there will remain a not unimportant residue of the results of past, present and doubtless future ignorance and lawlessness, which it seems unnecessary to inflict as a permanent legacy to scientific posterity.

Whether in using hybrid and barbarous names we are following in the lines which Latin literature would have taken is, after all, of relatively little importance. Convenient names which can be understood readily and remembered easily are the object of our quest. Names like *Sebastianoschaueria* and *Reichembachanthus* may be etymologically correct, but they are certainly not convenient, and the same may be said of many impersonal compounds of ungainly length, such as *Archispirostreptus, Necrophlæophagus* and *Synthiloborhamphus*. Apparently to avoid the labor of finding an unused short name, some systematists seek safety in huge polysyllables which they feel sure that none of their predecessors can have had the hardihood to perpetrate. But that these absurd creations are strung out in accordance with the rules of Greek grammar is scarcely a sufficient reason why systematic biologists must remain at the mercy of nomenclatorial indolence and folly. The man who named his daughter Encyclopedia Britannica was rewarded for his pains by hearing the neighbors call her 'Tan,' and similar abbreviations are in many instances in order among scientific names.

To avoid the numerous complications and uncertainties attending the subject of caconyms it has been suggested that names be treated as arbitrary symbols outside language and literature, to be preserved in their original forms, typographic errors and all. For such the names of Adanson and Hernandez are but opportunities for the display of zeal in the cause of priority. Indeed, one phonetic outrage at a time is evidently not enough for those who think to serve science by compelling us to say

such things as *Symphoricarpus symphoricarpus, Taraxacum taraxacum, Hypopitis hypopitis, Opuntia opuntia, Zizyphus zizyphus, Cracca cracca, Sassafras sassafras, Benzoin benzoin* and other gibberish first advocated by the ornithologists who evidently proceeded on the analogy of *Coo coo, Caw caw, Quack quack* and other sounds familiar to them, and did not foresee the certain fate of the tropical planter who should find as the result of his botanical studies that his garden contained *Cajan cajan, Manihot manihot, Malvaviscus malvaviscus, Jambosa jambos, Ananas ananas, Karatas karatas, Guazuma guazuma, Lebbek lebbėk* and *Lablab lablab,* to say nothing of the horrors he might encounter in the forest. And all this because Dr. Linnæus refused to accept numerous genera named by his predecessors, but used their generic names of species!

Those who believe that this historical complication compels the permanent use of duplicate binomials should begin practice with Chichictlapalezquahuitl, since the Juggernaut sect of devotees to priority has not hesitated to resurrect and even to make duplicates of equally barbarous, if less extensive, names from books much less scientific than Hernandez. If, as claimed by Mr. Pollard,* there is no middle ground between the correction of orthographic and typographic errors and the acceptance of all mistakes and barbarisms, a continuation of the present nomenclatorial tendencies will but prepare a welcome for the reformers who shall extend and complete the work of Professor Greene in the extirpation of incorrect, inconvenient and barbarous names, and the substitution of others justified by classical reference and usage; not primarily because such terms are Latin, nor because they are classical, but because it will have become apparent that adherence to a reasonably limited, never-changing vocabulary is the only safe basis for legislation in the interest of a convenient and stable nomenclature.

The hope that stability might be secured by the acceptance of incorrect, inconvenient, barbarous and nonsensical names is obviously vain, and it is rapidly becoming apparent that such concessions to ignorance, recklessness and freakishness carry with them more serious dangers than they avoid.* We could afford to have many differences of opinion and usage in the names of plants rather than accept taxonomic contributions like those of Hernandez and Adanson, and a stability which would bind us to such idols would be a doubtful blessing.

But notwithstanding its annoying complexity, the subject of caconyms has the redeeming feature that it can be treated quite apart from all other aspects of nomenclatorial reform, and as it is the side which touches nearest upon the field of general literature and individual opinion and taste, it is here that reliance upon usage or an agreement to disagree would be a benefit to systematic biology if it made possible the much-needed unanimity on the

* SCIENCE, N. S., XIV., p. 280, Aug. 23, 1901.

* The somewhat pharisaical complacency with which some of my zoological friends were inclined to view the Hernandez complication as a purely botanical difficulty is no longer appropriate in view of the recent delivery by a South American zoologist of a large brood of nomenclatorial monsters which, since they have come in the twentieth century, instead of in the sixteenth, show even more strikingly than those of Hernandez the necessity of nomenclatorial discrimination. Two protests have already appeared (*Osprey*, V., p. 142, Sept., 1901, by Professor Gill, and SCIENCE, N. S., XIV., p. 693, Nov. 1, 1901, by 'F. A. B.') but the authors of names like *Guilielmoscottia, Oldfieldthomasia, Edvardotrouessartia* and *Asmithwoodwardia,* are, of course, impervious to reason or to ridicule, and will be effectually deterred only by the refusal of systematists to recognize their multipedalian progeny as a legitimate part of biological taxonomy.

weightier principles and methods of taxonomic procedure. General legislation, to cover all normal instances, must be axiomatically rational, definite and simple if it is to be universally understood and approved, but there could be no serious objection to the reference of this semi-literary department of nomenclature to a permanent committee or academy, just as it has been found advantageous to have a board of specialists for officially determining the forms of geographic names. And it should also not be forgotten that if no direct provision for dealing with caconyms should prove possible, a large measure of relief from Adanson, Hernandez and other nomenclatorial incubi could still be obtained through closer adherence to the binomial requirement for genera as well as for species.

ESSENTIALS OF BIOLOGICAL NOMENCLATURE.

In the way of summary of the present and former discussions of the method of types* it may be repeated that the long-wished-for uniformity and stability could be secured by consistent adherence to a few simple and well-nigh axiomatic principles.

1. The primary object of formal nomenclature in systematic biology is to secure convenience, uniformity, and stability in the names of plants and animals.

2. Biological nomenclature should be treated as beginning with the general use of binomial Latin names for plants and animals.

3. A name must be used for the natural group to which it was first applied.

Moreover, if we begin from the practical end of the problem instead of viewing it merely from the literary standpoint, the formulation and application of these principles encounters far less serious complications than have attended the unstable method of elimination.

DESIGNATION OF TYPES.

1. The nomenclatorial type of a species is the specimen originally studied, named and described by the author of the specific name.

2. The type of a genus is the first species referred to it, and the generic name can be used only for species treated as congeneric with the type.

(*a*) The author may designate, however, some other species as type in the same paper in which the name is published.

(*b*) For a generic name adopted from a pre-Linnæan or a prebinomial writer the type species is selected without reference to the binomial system of nomenclature, but works older than Tournefort's 'Institutiones' (1700) should not be cited in botany.

CLASSIFICATION OF SYNONYMS.

Under the method of types names are rejected or treated as synonyms in biological taxonomy for the following reasons:

1. When preoccupied (homonyms).

(*a*) A generic name is preoccupied when it has been previously proposed for a different group of the same (plant or animal) series.

(*b*) A specific or subspecific name is preoccupied when it has been applied to a species or subspecies under the same generic name.

2. When there is an older valid name based on the same type (typonym).

3. When there is an older valid name based on another member of the same group (metonym).

4. When the natural group to which the name applies is undetermined (hyponym).

(*a*) A specific name is a hyponym when it has not been connected with a description identifiable by diagnostic characters or by reference to a type specimen, figure or locality.

(*b*) A generic name is a hyponym when it has not been associated with an identifiable binomial species.

5. When the form or signification of the name is inconvenient, incorrect or inappropriate (caconym), should a recognized method of dealing with these complications be formulated.

O. F. Cook.

Washington, D. C.,
February 10, 1902.

* *Bulletin of the Torrey Botanical Club*, 22: 431–434, October, 1895; Science, N. S., 8: 186–190, August 12, 1898; Science, N. S., 8: 513–516, October 14, 1898; *American Naturalist*, 33: 287–297, April, 1899; Science, N. S., 12: 475–481, September 28, 1900; Science, N. S., 13: 712–713, May 3, 1901.

SPRING MEETING OF THE COUNCIL OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE Council of the American Association for the Advancement of Science met on April 17 in the Assembly Hall of the Cosmos Club at Washington. President Minot occupied the chair and President-elect Asaph Hall was in attendance as were also Messrs. Benjamin, Cattell, Clarke, Fewkes, Galloway, Gilbert, Gill, Howard, Hyde, Lee, McGee, Morley, Nichols, Pearson, Peters, Stiles, von Schrenk, Welch, Woodward and Wright.

The Permanent Secretary presented a report upon the operations of his office since the midwinter meeting of the Council held at Chicago, Ill., January 1. The delay in the publication of the Denver volume was explained in part by the delay in the receipt of certain manuscripts from Secretaries of Sections and in part by the new conditions which govern the administration of the firm of printers which has handled the volume the past two years. The volume is now entirely in type and will probably be ready for distribution in a week or so. A list of the new members elected by the subcommittee of the Council empowered to act promptly on applications was presented and the statement was made that in past fifteen months 1,566 persons have been elected, of whom 1,406 have completed membership.

Arrangements for the Pittsburg meeting are progressing favorably. The Permanent Secretary visited Pittsburg on March 22, and met about fifty members of the Local Committee, selected the rooms for the meetings of the different sections and the affiliated societies, ascertained that a substantial fund had been subscribed, and that the people of Pittsburg are interested in the meeting and are looking forward to it with pleasure. It was also announced that preliminary arrangements are already being made for the probable Washington meeting during Convocation Week, beginning December 28, 1902. The Columbian University and Georgetown University have promised the use of all of their University buildings for meeting rooms.

The financial report of the Permanent Secretary for the calendar year 1901 was presented and was approved by the Council and ordered placed before the Association at the Pittsburg meeting. The report shows receipts during the year of $21,373.59, and a balance on hand December 31, 1901, of $12,285.83, after transferring to the Treasurer the sum of $2,050.00

The committee appointed at the midwinter meeting with power to act upon the application of the Bibliographical Society of Chicago with regard to a bibliographic exhibit at the Louisiana Purchase Exposition, reported, through Mr. Cattell, that the committee had notified the Society that the Association regards it as desirable for the Exposition to secure the advice of expert bibliographers in the compilation of its publications and to arrange if possible for an international bibliographical exhibit.

The Committee on Convocation Week reported, through its chairman, Dr. Minot, that since the last report agreements to 'Convocation Week' arrangements have been received from a number of universities and colleges, including the University of Illinois, Lehigh, Cincinnati, Indiana, Van Rensselaer, Dartmouth, Iowa, Brown, Smith, McGill, Lafayette, Ohio, Pennsylvania, Wisconsin, Nebraska, Toronto, Georgetown, making a total of 54 in all, only two of which are outside of the United States.

An intimation having been received by the Council that the American Philological Association, the Archæological Institute of America and the American Philosophical Association might welcome an invitation from the Association to affiliate with the

Association it was moved and carried that an invitation be extended to these organizations.

Dr. Minot reported from the subcommittee upon the affiliation of certain of the medical societies that the invitation to affiliate was sent out to several societies, but that sufficient time had not elapsed to allow these societies to take action.

Dr. Lee reported that the Council of the American Physiological Society had resolved to report favorably upon the proposition of the Association as a whole, but that action by the Society cannot be taken until its next meeting.

An appropriation of $25 or so much thereof as may prove necessary was made for the purpose of sharing in the expense attending the reception of Lord Kelvin to be held by several national scientific organizations in New York City on April 21.

A letter was read from the Librarian of the Manchester (N. H.) Institute of Arts and Sciences, stating that their library had been destroyed by fire last January, and, on motion, the Permanent Secretary was directed to present to the Institute as full a set of the Proceedings of the Association as should prove practicable.

A letter from Dr. Franz Boas relating to a proposed 'Association of American Anthropologists' was read, in which he asked the opinion of the Council of the Association concerning the possibility of a practical substitution of this national society for Section H of the American Association, all members of the new society becoming members of the American Association, the society to have the privilege of levying additional assessments of its own. Some discussions ensued and a motion by Mr. Gilbert was finally adopted to establish a committee on the relations of the A. A. A. S. to other scientific organizations and that the proposition from Dr. Boas be referred to this committee. It was further moved and carried that the President of the Association be made a member of the committee.

The following resolution was read by Mr. Cattell:

Resolved, That the Permanent Secretary be authorized to collect the dues of members of societies affiliated with the Association if requested to do so by any of those societies.

Dr. Stiles moved that the Committee on Convocation Week be requested to take into consideration the advisibility of addressing officials in charge of Government scientific bureaus in an effort to secure action which will result in the detail of scientific men in the employment of the Government to attend scientific meetings held during Convocation Week without prejudice to their annual leaves of absence, thus accomplishing for this class of workers what the committee has been able to secure through the different universities for the teachers in the higher educational institutions.

The Secretary-elect of Section I, Professor W. F. Wilcox, having resigned through press of work, on motion of Mr. Hyde, Frank R. Rutter, of Washington, D. C., was elected Secretary of Section I.

SCIENTIFIC BOOKS.

THE DUTCH EXPEDITION TO THE MALAY ARCHIPELAGO.

Siboga-Expeditie, Introduction et Description de l'Expédition. Par Max Weber, Monographie I.

This is the first of a series of sixty-five monographs which are to appear from time to time as the results of the cruise of the *Siboga* through the Malay Archipelago. One need hardly add that such a series, under the authorship of many of the best known continental specialists, will prove an important complement, if not a rival, to the reports of the *Challenger*.

The introductory monograph by Professor Max Weber, director of the expedition, gives a clear outline of the proposed work, a historical summary of the researches relating to this region and a condensed journal of the cruise during its year of collecting.

Great interest in the biology of their East Indies has always been shown by the Dutch, and the rich tropical fauna and flora of this region have already been examined at first hand, although in but a preliminary way, by many of their best observers. The present expedition can, therefore, be looked upon as the logical outcome of a cumulative interest. Not long since a society was formed for the 'Encouragement of Explorations in the Colonial Possessions of the Netherlands,' and it was at the instance of this society, through the efforts of Professor Hubrecht, of Utrecht, and other leading zoologists, that the Dutch government lent its aid to the undertaking. This materialized in the loan of an admirably equipped war vessel, the *Siboga,* for the purpose of a general exploration of the marine fauna of the Dutch East Indies. Among zoologists generally, it is well known that the *Siboga* started on its cruise under exceptionally favorable auspices; no vessel was better equipped for zoological collecting, and its naval personnel, from Captain Tydeman down, was selected with extreme care—the latter feature almost as important to the staff of naturalists as the former. The vessel started on its cruise in March, 1899, returning to Java without mishap just a year later. Over three hundred dredging stations were recorded at points well scattered throughout the archipelago. The itinerary was a long one; the vessel passed first along the southern row of islands as far as Timor, thence northerly through the Strait of Makassar, as far as the Sulu group in the Philippines; thence back to Celebes, then again northerly to the neighborhood of the Philippine Island, Mindanao; thence southerly through the Molucca passage, and among the islands of the sea of Ceram, as far as the coast of New Guinea; thence through the sea of Banda, and among the southern group, Timor, Flores, Lombok, back to Java. The present monograph gives, although in a concise form, an idea of the fauna of the little-studied deep and shallow waters of the archipelago, and of the wealth of material which now has been distributed among the specialists who are to report upon the collections. Hardly of less interest are the extensive researches undertaken by Captain Tydeman and the party in the hydrography of this region.

It is a difficult task for the reviewer to select the most important of the points brought out in the first monograph. One may pick out at random these: There is evidence that the famous 'Wallace's line' between Borneo and Celebes, is far less distinct than formerly believed, and indeed of minor importance in the matter of the distribution of marine forms; in this regard we note that the narrow strait between Bali and Lombok through which this line passes is much shallower than heretofore believed, practically within the one hundred fathom mark.

Important too is the discovery of actual barriers separating the deep waters, or seas of the archipelago from the neighboring oceans, barriers which had long been conjectured to account for the fact that the deep waters of the archipelago, *i. e.,* those greater than 1,600 meters, are of uniform temperature (about 3 degrees C.), while those of adjacent oceans become colder as the depth increases. The present memoir contains many interesting biological notes. We may cite, as examples, the reference to the Palolo worm, whose extraordinarily regular and sudden mode of occurrence has so long puzzled zoologists; the method of sailing by the sword fish, *Histiophorus;* the relations of *Lithothamnion* colonies; curious aboriginal methods of fishing; notes on shallow water phosphorescent fishes; measurement (in candle power) of the flashes of the phosphorescent fish, *Photoblepharon;* living conditions of glass sponges; notes on *Coccosphæra,* much discussed of deep-sea expeditions—these are shown to be plants, their chromatophores and division having been studied in living material by Mme. Weber.

Among geological notes we find that Mesozoic deposits, hitherto known only in and near

Java, are continued throughout a number of the easterly islands: also that in deep water and distant from shore, land remains such as fruit and leaves of palms are found in dredgings, confirming from this region the observations of Alexander Agassiz on the *Blake*.

Bashford Dean.

Die Reizleitung und reizleitenden Strukturen bei den Pflanzen. By B. Němec. Jena, G. Fisher. 1901. Pp. 153; pl. 2. Price, Mk. 7.

Nowadays it is to be expected that any theory developed in connection with the phenomena of animal life will quickly be applied to investigation in the action of plants and *vice versa*. Witness the well-known exploitation of heliotropic phenomena in animals after their elaboration in plants. Since the discovery of the fibrillar structure in the nervous system of animals and the development of the neuron theory have shed so much light upon the propagation of impulses in animals, it was to be expected that similar investigations should be made upon plants. This has been done by Němec and the results are embodied in a book of considerable size.

Though he gave some attention to geotropic and other stimuli, Němec studied chiefly the propagation of the stimulus caused by wounding, because this manifests itself by a notable disturbance in the structure of the cell. The protoplasm of cells adjacent to the wound aggregates upon the side of the cell next to it, whither also the nucleus migrates. This disturbance spreads in all directions at a definite rate (in the root of onion about 1.25 mm. lengthwise in the first fifteen minutes), and recovery follows shortly. The propagation is most rapid in the longitudinal axis. Němec sought a structural basis for this difference and believes that he has found it in protoplasmic strands or fibrils, which are readily demonstrable in certain cells, particularly those of the plerome. These strands run lengthwise from one end of the cell to the other and are resolvable, with proper staining and magnification, into fibrils, each of which is surrounded by a distinct sheath. In the center of the cell the strands are often large and distinct, but near the ends they spread out into a brush of fibrils, which reach the wall but do not penetrate it. According to Němec, propagation of the impulse takes place along these fibrils, becoming general and diffuse in the protoplasm at the ends of the cells, and passing from one cell to another by way of the minute general protoplasmic connections, which by analogy he assumes to exist, though he does not demonstrate them. Němec lays much stress upon the fact that in adjacent cells the fibrils correspond on opposite faces of the wall, though the significance of this point is not clear in view of the lack of demonstrable connection through the wall. Such fibrillar structures were found in several monocotyles, dicotyles and some ferns. Inasmuch as operations for the removal of the fibrils alone were impossible, Němec caused their degeneration by sudden changes of temperature, finding afterwards the rate of propagation retarded. In roots of *Vicia Faba*, where fibrils are found only in the plerome, the severance of the plerome inhibited geotropic curvature entirely or at least above the cut, the inference being that it did so by interruption of the fibrils.

The work of Němec is certainly a careful and thorough piece of research, which will doubtless stimulate further inquiry along this line. It is not convincing, however, in its present stage. The author himself admits that impulses are transmitted by cells in which there are no fibrils, holding only that when present they facilitate propagation. If this be true they should be best developed in those organs whose reactions are quickest. Yet Haberlandt—who has already interested himself in the problem—has been unable to discover them in the vicinity of the sensitive hairs of *Aldrovandia*, the stamens of *Opuntia*, or the tendrils of *Cucurbita*. Further, it should be noted that the cell rows in which the fibrils are best developed—often those which become tracheæ—are not only an unlikely line of transmission but that no actual protoplasmic connection in them has been shown. Finally, the experiments showing retardation following interruption or disorganization of the fibrils are inconclusive because

the same conditions might inhibit the action of the real lines of propagation, whatever they are.

Further investigation is demanded for the elucidation of this interesting problem.

C. R. BARNES.

THE UNIVERSITY OF CHICAGO.

Roscoe-Schorlemmer's Ausführliches Lehrbuch der Chemie. Von JUL. WILH. BRÜHL, Professor an der Universität Heidelberg. Neunter Band, *Die Kohlenwasserstoffe und ihre Derivate oder organische Chemie;* Siebenter Theil. Bearbeitet in gemeinschaft mit EDWARD HJELT und OSSIAN ASCHAN, Professoren an der Universität Helsingfors, O. COHNHEIM, O. EMMERLING und E. VAHLEN, Privatdocenten an der Universitäten Heidelberg, Berlin und Halle, A. S. Braunschweig, Druck und Verlag von Friedrich Viewig und Sohn. 1901.

The present volume, being the seventh volume of 'Organic Chemistry,' and the ninth volume of Roscoe-Schorlemmer's 'Ausfürhliches Lehrbuch der Chemie,' constitutes the closing volume of this important work. It deals with three distinct topics of physiological chemistry, viz., the 'Chemistry of the Albuminous Bodies and the Constituents of Bile,' written by Dr. O. Cohnheim, of Heidelberg; 'Enzymes,' written by Dr. O. Emmerling, of Charlottenburg; 'Ptomaines and Toxines,' written by Dr. E. Vahlen, of Halle.

The section on proteids covers 331 pages, and is a well-presented statement of facts and theories bearing on the various classes of proteids of physiological interest. It is thoroughly up-to-date, and makes a valuable addition to the list of handbooks which aim to present a systematic account of the chemical nature of this important group of proximate principles.

The section on 'Enzymes' is divided into eight chapters, dealing respectively with enzymes which have a splitting action on monosaccharides, disaccharides, polysaccharides, glucosides, glycerides, etc., while other chapters or subsections deal with oxidizing and reducing enzymes, clotting enzymes, proteolytic enzymes of both animal and vegetable origin, amide-splitting enzymes, etc.

The last section of the book, by Dr. Vahlen, deals with ptomaines and toxines, and constitutes an interesting chapter on the chemistry of these products of bacterial life and growth.

The volume, as a whole, reflects great credit upon the several authors, and will undoubtedly prove of great service as a reference handbook for physiological chemists.

R. H. CHITTENDEN.

History of Geology and Paleontology to the End of the Nineteenth Century. By KARL ALFRED VON ZITTEL. Walter Scott. 1901. 16mo. Pp. xiii+562.

This work is timely. Lyell's synopsis of views and opinions comes down to barely seventy-five years ago; Whewell's chapters on geology, though nominally covering the period down to 1855, are unsatisfactory at best; d'Archiac's work, too voluminous for the ordinary student, ends with 1859; while nearly all of the other so-called histories are histories, not of the science as a whole, but of separate branches surrounded by a framework of chapters upon other branches. The preparation of a history of geology and paleontology is no longer a simple task, and before many years it will be an almost impossible task, for the several lines of investigation now embraced under the general title of geology are fast becoming wholly independent sciences. One must welcome this history, covering the whole period to the end of the nineteenth century, prepared by one who first attained eminence in geology and afterwards turned with equal success to paleontology.

The introduction of 153 pages reviews the steps by which the science advanced. The synopsis of opinions held by ancient writers is just, with full recognition of their merits, yet showing their defects in such manner that no excuse remains for regarding the Greek philosophers as gifted beyond modern students. One hundred pages are devoted to the 'heroic age,' 1790 to 1820, in which one finds appreciative discussions of the doctrines presented by Werner, Hutton, Playfair, Humboldt, Kant and the rest, which, too often, have received either unstinted praise or unstinted censure.

The story since 1820 is told briefly, as that is given in detail beyond.

The main portion of the work contains chapters on cosmical, physiographical, dynamical and stratigraphical geology, petrography and paleontology, which are not mere narratives, not mere synopses of individual contributions: they are true histories; the opinions of investigators are given, their value discussed and their bearing upon the advancement of the science determined. The reader may detect here and there evidence of positive bias, or he may feel that the decision is inexact, but in every instance he must recognize the author's effort to maintain a judicial attitude—and it may be said that the effort has been so far successful as to place the work in a class by itself.

The statement has been made frequently that Germans are inclined to ignore the work of English-speaking peoples, but there is no trace of any such inclination in this work. Professor Zittel has been a faithful student of British and American contributions, and the references to such titles compare in number very favorably with those to works in German or French. This history will prove more than serviceable to the geologist who finds the daily accumulation of literature bearing upon his own immediate line of work so burdensome as to prevent him from keeping track of advance along other lines.

Mrs. Ogilvie-Gordon, the translator, has done her work well, for hardly a trace of German idioms remains. The text is enriched with brief biographical notices of deceased geologists and with thirteen portraits. The index of authors is complete and in a measure replaces the bibliography, which the British publisher felt compelled to omit. The index of subjects is less satisfactory, being much too brief.

John J. Stevenson.

SCIENTIFIC JOURNALS AND ARTICLES.

The April number (Vol. III., No 2) of the *Transactions of the American Mathematical Society* contains the following papers: 'On the Small Divisors in the Lunar Theory,' by E. W. Brown; 'On the Holomorphisms of a Group,' by J. W. Young; 'A Simple Non-Desarguesian Plane Geometry,' by F. R. Moulton; 'On the Real Solutions of Two Linear Homogeneous Differential Equations of the First Order,' by M. Bôcher; 'On a Recent Method for Dealing with the Intersections of Plane Curves,' by C. A. Scott; 'A Complete Set of Postulates for the Theory of Absolute Continuous Magnitude,' by E. V. Huntington; 'Complete Sets of Postulates for the Theories of Positive Integral and of Positive Rational Numbers,' by E. V. Huntington.

The April number (Vol. VIII., No. 7) of the *Bulletin of the American Mathematical Society* contains the following articles: 'The February Meeting of the American Mathematical Society,' by E. Kasner; 'Note on the Transformation of a Group into its Canonical Form,' by S. E. Slocum; 'Some Applications of Green's Theorem in One Dimension,' by O. Dunkel; 'On the Forms of Quintic Scrolls,' by V. Snyder; 'Simplified Definition of a Group,' by E. V. Huntington; 'Note on Isotropic Congruences,' by L. P. Eisenhart; 'Kronecker's Lectures on the Theory of Numbers,' by G. A. Miller; 'Notes' and 'New Publications.'

The *Botanical Gazette* for March contains the following: Professor Frederick C. Newcombe, of the University of Michigan, publishes the first instalment of a paper upon the 'Geotropism of Roots,' the result of a number of years of investigation. His results will be noted upon the completion of the paper. Miss Alice Eastwood, of the California Academy of Sciences, continues her descriptions of an interesting collection of plants from Nome City, Alaska, describing several new species and completing descriptions of many species already poorly known. John Gallatin Hall has published some interesting results of an embryological study of *Limnocharis emarginata*, a South American member of the Alismaceæ. Some of the interesting features are as follows: The tapetal cell of the ovule is cut off, but no division wall is formed, the cell disappearing early; the antipodal cell following the first division of the megaspore nucleus remains undivided, so that there is no antip-

odal group or lower polar nucleus; the upper polar nucleus migrates to the antipodal end of the sac and there divides, one daughter-cell remaining in that position and becoming cut off by a wall across the sac, the other moving back to the egg and eventually forming a considerable mass of endosperm; fertilization takes place very soon after pollination, material killed within eighteen hours after pollination showing the embryo in a two-celled stage; in addition to the ordinary development of a single embryo, polyembryony may occur, as in *Erythronium* and *Tulipa,* by the division of the suspensor cell to form an extensive embryogenic mass of tissue. C. L. Shear, of the Department of Agriculture, discusses generic nomenclature, bringing up the difficulties connected with determining generic names among certain fungi. He does not offer a set of rules, but reaches the conviction that the so-called 'type-method' is both desirable and practicable. He urges the importance of selecting a starting point for genera, definite provision being made for the treatment of genera having no binomial species referred to them at the time of their original description. W. W. Ashe, of Raleigh, North Carolina, describes new species of *Fraxinus, Tilia* and *Cratægus;* while Newton B. Pierce, of the Department of Agriculture, describes as a new species (*Alternaria citri*) the fungus disease of navel oranges that has attracted attention in California for the past eight or ten years, and which is popularly known as 'black rot of oranges.'

IN *Popular Astronomy* for April, Percival Lowell, of Boston, gives an 'Explanation of the Supposed Signals from Mars of December 7 and 8, 1900.' Many will recall that it was then reported that Mars had been signaling the earth; that lights had suddenly shone out brightly, and then vanished. The explanation is that this misrepresentation came from a telegram sent to Mr. Lowell as to a projection then observed on the surface of Mars, similar to those more often seen on the moon. From a study of the projections on Mars, the writer believes that these are due to clouds floating in the air rather than to mountains on the surface.

George C. Comstock writes of the 'Motion of Comets when far from the Sun.' He speaks of comets as they are commonly considered, as mere visitors who come from the region of the fixed stars, and after a temporary sojourn here return. An interesting popular article on the 'Zodiacal Light' is written by Arthur K. Bartlett, of Battle Creek. This light which is seen at this time in the year on any clear moonless night after sunset might be mistaken for the aurora borealis by those unacquainted with astronomy, were it not for its position and form. Its form is that of a cone or pyramid having its top rounded, and its base directed toward the sun, and with a light like that of the Milky Way. Mr. Bartlett speaks of the various theories to which this illumination has been, and is, attributed, inclining towards the one most generally accepted, though not established, viz., that of meteors combining in unknown millions, reflecting to our eyes the peculiar light in question, borrowed from the sun, around which they revolve probably as do the planets. The usual amount of space is given to current news and notes of comets, asteroids, planets and variable stars, and to various short articles.

SOCIETIES AND ACADEMIES.

NATIONAL ACADEMY OF SCIENCES.

THE annual stated session of the Academy was held in Washington, D. C., April 15 to 17, inclusive.

President Alexander Agassiz presided at the meetings, which were attended by the following members: Messrs. Abbe, Abbot, Agassiz, Allen, Becker, Billings, Boas, Boss, Brewer, Brooks, Cattell, C. F. Chandler, S. C. Chandler, Chittenden, C. B. Comstock, Crafts, Dall, Emmons, Farlow, Gilbert, Gill, Hague, Hall, G. W. Hill, Langley, Minot, S. W. Mitchell, Moore, Morley, Newcomb, Nichols, Osborn. Peirce, Penfield, Pickering, Prudden, Remsen, Richards, Sellers, E. F. Smith, Walcott, Welch, White, and Woodward.

Most of the time during the sessions was devoted to routine business, hearing reports from the officers of the Academy, chairmen of

standing committees, trust funds, etc., and reading scientific papers.

Mr. Samuel F. Emmons, of Washington, D. C., was elected treasurer of the Academy in place of Mr. C. D. Walcott, resigned.

The following gentlemen were elected members of the Academy: William W. Campbell, Director of Lick Observatory, Mount Hamilton, California; George E. Hale, Director of Yerkes Observatory, Williams Bay, Wisconsin; C. Hart Merriam, Chief of the Division of Biological Survey, U. S. Department of Agriculture, Washington, D. C.; William Trelease, Director of the Missouri Botanical Garden, St. Louis; Charles R. Van Hise, Professor of Geology, University of Wisconsin, Madison.

The Academy will next meet in Baltimore on November 11.

The scientific program was as follows:

'Evolution of the Titanotheres, III.,' Models and Restorations: HENRY F. OSBORN.

'Homoplasy and Latent Homology; A Correction': HENRY F. OSBORN.

'Evidence that North America and Eurasia Constituted a Single Zoological Realm during the Mesozoic and Cenozoic, and that Correlations can be Established as a Basis for Uniformity of Geological Nomenclature': HENRY F. OSBORN.

'Monograph of the Bombycine Moths of America, including their Transformation; with a Revision of the Known Genera, Part III., Sphingicampidæ': ALPHEUS S. PACKARD.

'On the Coral Reefs of the Maldives': ALEXANDER AGASSIZ.

'On the Theory of the Formation of Coral Reefs': ALEXANDER AGASSIZ.

'Psychophysical Fatigue': J. McK. CATTELL.

'On Some Optical Properties of Asphalt': EDWARD L. NICHOLS.

'The Classification of the Sciences': CHARLES PEIRCE.

'The Postulates of Geometry': CHARLES S. S. PEIRCE.

'The Color System': CHARLES S. PEIRCE.

'The Compulsory Introduction of the French Metrical System into the United States': WILLIAM SELLERS.

'The Disintegration of Comets': ASAPH HALL.

'A New Computation of the Coefficients of Precession and Nutation': : IRA IBSEN STERNER. Introduced by Asaph Hall.

'The Distribution of the Stars': E. C. PICKERING.

'The Variability in Light of Eros': E. C. PICKERING.

'The Physiological Station on Monte Rosa': H. P. BOWDITCH. (With lantern illustrations.)

'On Catalysis': JAMES M. CRAFTS.

'The Atomic Weight of Cæsium': T. W. RICHARDS.

'The Significance of Changing Atomic Volume': T. W. RICHARDS.

'Determination of the Weight of the Vapor of Mercury at Temperature Below 100°': EDWARD W. MORLEY.

'Biography of Professor William A. Rogers': ARTHUR SEARLE. Presented by Edward W. Morley.

'Biographical Memoir of General J. G. Barnard': HENRY L. ABBOT.

'Biographical Memoir of General Francis A. Walker': JOHN S. BILLINGS.

'Biographical Memoir of J. S. Newberry': C. A. WHITE.

'The Present Aspect of Our Knowledge as to the Constant of Aberration': S. C. CHANDLER.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

AT the meeting of the Society on March 26 the first paper, by Mr. M. L. Fuller, was entitled 'The Catskill Rocks in Northern Pennsylvania.' The term Catskill was used by the speaker to indicate the great series of shales and sandstones, predominantly red in color, which constitute the upper portion of the Devonian sediments in Pennsylvania and New York. The progressive rise of the plane of the lowest red beds to the westward was shown by sections. In the Catskill mountains the lower red beds rest upon the Hamilton, while in Columbia County, Pennsylvania, they appear only after some 1,850 feet of Ithaca and 450 feet of Chemung beds had been deposited. Again, near Tioga, Pennsylvania, 1,500 to 2,000 feet or more of Chemung rocks are exposed beneath the red beds without the bottom being shown, while still further west, near Salamanca, New York, the red beds occur within an interval of some 250 feet below the Olean conglomerate (Pottsville?). At the same time the thickness of the red division has decreased from nearly 5,000 feet in Columbia County, Pennsylvania, to practically nothing in the northwestern portion of the Salamanca quadrangle in New York.

The two divisions of the red series in northern Pennsylvania, provisionally called the Catskill and Oneonta divisions, were described. The Oneonta division was shown to be some 300 feet thick in western Bradford County, Pennsylvania, and to be separated from the Catskill by 350 feet or more of typical marine Chemung. Some 25 miles further west, near Mansfield, the division is represented only by one or two thin beds occurring about 400 feet below the Catskill. Both the lower and upper limits of the Oneonta division were shown to be rising to the westward, indicating that the incursion of the sea and its marine fauna probably took place in Bradford County while red beds were still being deposited in Tioga County on the west.

In considering the age of the red beds at their extreme western limits near Salamanca, New York, it was shown that their stratigraphic position agrees with that of the Pocono in eastern Pennsylvania and with the Waverly in western Pennsylvania. A marked change of fauna, including the introduction of fifty new species, of which seven were of Carboniferous type, was shown to have occurred immediately below the red beds in the region just east of Salamanca, and was regarded as marking the beginning of a transition into the Carboniferous, or possibly the introduction of the Carboniferous itself. The proposition that these beds, with the included red shale, belong beneath the Waverly, and that the latter may have been entirely cut out in this region by the unconformity at the base of the Pottsville was regarded as possible, but as not established.

Mr. Thomas H. Means, of the Bureau of Soils, then presented a very interesting paper, entitled 'Some Results of the Soil Survey.'

Mr. Means reviewed briefly the development of soil studies in the United States and described the methods in use in the Bureau of Soils. Sixteen thousand square miles have been surveyed, the areas being generally distributed through the principal physiographic provinces of the country. A survey is now in progress in Porto Rico. Large areas have been surveyed in the irrigated lands of the western United States. In these areas, besides a study of the soils, the question of alkali in the soils has received particular attention and methods for the reclamation of the alkali lands have been worked out. The maps as issued by the Bureau are principally for the use of the farmers and therefore the classification of the soils is agricultural rather than geological. Mr. Means exhibited a number of soil and alkali maps and described their principal features.

Mr. F. C. Schrader presented a paper, entitled 'The Geological Section of the Rocky Mountains in Northern Alaska,' illustrated by lantern. The southern end of the section is on the Koyukuk River, a northern tributary of the Yukon, and it extends northward to the Arctic Ocean, following approximately the 152d meridian. Beginning at the southern end, the first hundred miles of the section traverses a dissected upland, made up of sandstones and slates and some limestones. These are known to be in part Lower Cretaceous beds, and the remainder are believed to be Cretaceous, or at least Mesozoic. North of this upland is a rugged mountain range, having a width of some eighty miles and reaching altitudes of some 6,000 feet.

Orographically this range is considered to be the northwestward continuation of the Rocky Mountains of the United States and of British Columbia, which here trend nearly east and west across northern Alaska, forming the great trans-Alaskan watershed between the Yukon on the south and the drainages of the Arctic Ocean on the north. On the south the rise from the rolling Koyukuk country to the mountains is rather abrupt; on the north the mountains break off abruptly, much as they do along the edge of the Great Plains in the western United States. Pronounced faulting and uplift are evidenced by marked deformation of the strata and the presence of prominent fault scarps, often miles in extent. A view across the top of the range has the general appearance of a dissected plateau or uplifted peneplain, whose former surface is marked by a sea of peaks which rise to a general level of about 6,000 feet, while the valley floors lie approximately at 2,000. The range, however, seems to be somewhat higher near its

northern and southern margins than in its central mass. It may therefore be regarded as having two axes, each formed by the older Paleozoic rocks, which seem to mark lines of maximum uplift. Continued with diminishing height to the westward, the northern axis seems to terminate in the Paleozoic rocks which form the low mountains and set cliffs at Cape Lisburne, while the southern axis marks the watershed between the Noatak and Kobuk rivers. The rocks composing the range comprise several metamorphic series of limestones, slates, conglomerates, and some schists, ranging from Upper Silurian to Lower Carboniferous, and all much older than the rocks forming the rolling plateau country on either side of the range.

Along its northern base the range is met by a gently rolling plateau country, 2,000 feet high, composed of Lower and Upper Cretaceous beds. This plateau slopes gently to the north for one hundred miles, where it falls off to the Arctic coastal plain. This coastal plain is underlain by Tertiary beds of Pliocene and Oligocene. In the Cretaceous plateau country the aspect of the topography is softened by the presence of drift, showing glacial action to have extended nearly one hundred miles to the north of the mountains. The Colville, like other of the large rivers of northern Alaska, has by lateral migration so encroached upon its western bank that it now enters the ocean at a point approximately thirty miles west from where it debouched in late Tertiary or early Pleistocene time. Along the coast the margin of the coastal plain is fringed by tidal lagoons and embayments and dotted by lakelets. In the low bluffs and sea cliffs ground ice is in many places exposed. These ice strata rise to a height of twenty feet above sea level and extend inland for unknown distances, while the surface is mantled by a sheet of muck and moss but a foot or two in thickness.

Alfred H. Brooks,
Secretary.

CHEMICAL SOCIETY OF WASHINGTON.

The 133d regular meeting of the Chemical Society of Washington was held March 12. The following program was presented:

Dr. W. F. Hillebrand: 'Common Errors in the Determination of Silica.' This paper was presented by Dr. Hillebrand at the winter meeting of the American Chemical Society, and was published in the April number of the *Journal of the American Chemical Society.*

Dr. E. T. Allen: 'Researches on the Oxides of Tungsten.'

1. When tungstic acid is reduced by stannous chloride at 100° C., or by hydriodic acid in sealed tubes at 200° C., the product is an indigo-blue powder of the composition $W_5O_{14}.H_2O$. This compound is changed to tungstic acid by most oxidizing agents. In hydrochloric acid it is insoluble. Caustic alkalies dissolve it with evolution of hydrogen and formation of alkaline tungstate. So far no salt has been obtained from it. Its formula agrees with that of the blue oxide of molybdenum, $Mo_5O_{14}.6H_2O$, recently studied by Guichard.

2. Concentrated ammonia extracts tungstic acid from the blue oxide, leaving a residue which is purple with a strong bronze luster. Its formula is $W_3O_8.H_2O$. The chemical properties of this body are similar to those of the blue oxide. Thus it is insoluble in hydrochloric acid, soluble in caustic alkalies with evolution of hydrogen, and more readily attacked by oxidizing agents than the blue oxide. It finds an analogue among the oxides of uranium ($U_3O_8.xH_2O$).

3. In composition and color these two oxides are closely related to the tungsten bronzes. Thus we have $W_5O_{14}.M_2O$, where $M_2=K_2$, Na_2, Li_2, or Ba, all *dark blue* in color; and $W_3O_8.M_2O$, where $M_2=Na_2$ or K_2, both having a metallic luster, while $W_3O_8.K_2O$, described by Hallopean as a reddish-violet powder with a copper reflex, recalls $W_3O_8.H_2O$ in a striking way. Direct transformation of these bronzes into the two oxides mentioned in this paper, or *vice versa,* has not been accomplished.

L. S. Munson,
Secretary.

BOSTON SOCIETY OF NATURAL HISTORY.

At the general meeting of the Society held on February 5, 1902, the president made the

formal announcement of the death, on January 15, of the Curator, Alpheus Hyatt. He spoke feelingly of his cordial and courteous personality, his unfailing good-humor and his deep interest in the development of the Society's work. At the close of these remarks, it was unanimously voted to request the Council to make arrangements for a memorial meeting for Alpheus Hyatt.

The paper of the evening was by Mr. George B. Gordon, who spoke of 'Recent Explorations by the Peabody Museum in Guatemala and Honduras.' He gave an account of the first expeditions by white men into this region, and pointed out that General Cortez, in his two years' march from the City of Mexico to Honduras, found the country a wilderness and had great difficulty in obtaining any provisions. A considerable amount of work has been done by the Peabody Museum of Archeology and Ethnology in uncovering and investigating the vast ruins of the Mayas, buried in the depths of the tropical forests of this region. The city of Copan, which has been to a great extent uncovered, appears to be the oldest of these ancient communities. A number of lantern slides was exhibited, illustrating the types of monoliths, altars and temples. Mr. Gordon also gave an account of an exploration of a large limestone cave, in which was found a very deep pit. With some difficulty the explorer was lowered into the pit, and found the floor covered with fragments of human bones. He suggested as a possible explanation of this fact that the cavern was used as a temple by the ancient tribes, and the bones were those of victims sacrificed to the Cave God, by being hurled into this chasm.

At the meeting of February 19, Professor W. O. Crosby presented a careful and detailed treatise on the 'Origin of Eskers.' He pointed out that the deposits classed as eskers have doubtless been formed under various conditions, and that a stationary ice-margin was highly favorable, if not essential, to such formations. The evidence of existing ice areas and glaciers seems to shed little light on the problem. The theories of esker formation were considered in detail, and the defects of the subglacial theory of origin were pointed out. A superglacial origin was considered to be much more probable. The material for such superglacial deposits could easily have been derived from englacial detritus, which, as is known, is constantly working up toward the surface of the ice, as the ice-sheet moves onward. This detritus would be acted upon by superficial streams. The ice-floor of a superficial stream is lowered by base-leveling, and by the melting away of the ice from below. The channel thus continues to aggrade, while at the same time the deposits consequent on aggradation are being let down, so that the final grade is that of the ground below. In further support of this theory, the speaker cited the general absence of any correlation of the meanders of eskers to the present topography, a fact which is almost inexplicable by the subglacial theory of formation. The material of these deposits, too, could hardly be so great as it is, if the subglacial theory be accepted, for a subglacial stream could have gained little from englacial drift, and not largely either from the ground moraine. In conclusion, Professor Crosby considered the eskers and sand plains of Newtonville and Auburndale, especially in their bearing on the two main theories of esker formation.

An account of an 'Entomological Collecting Trip in the Highlands of Bolivia,' from the advance sheets of a forthcoming work by Mr. A. G. Weeks, Jr., was read. A graphic description of the topography and general features of this almost unexplored region was given and several finely executed colored plates were shown, illustrating hitherto unfigured Lepidoptera.

GLOVER M. ALLEN,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis on the evening of March 17, Dr. E. R. Buckley, State Geologist of Missouri, addressed the Academy on the work being done by the State Bureau of Geology and Mines, giving a brief review of the work done by the Bureau in the past, since its creation in 1839, and an outline of the plans for the future.

At the meeting on April 7, Dr. A. S. Langsdorf, of Washington University, delivered an address on Electric Waves, the explanations being illustrated by experiments, including some of the phenomena of self-induction, absorption, reflection and resonance.

Dr. H. von Schrenk exhibited a sample of the impregnated wooden paving blocks used on some of the streets of London and Paris.

One person was elected to active membership.

WILLIAM TRELEASE,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

SECTION D, MECHANICAL SCIENCE AND ENGINEERING OF THE AMERICAN ASSOCIATION.

THE next meeting of the American Association occurs at Pittsburg, June 28–July 3, of this year.

The various Carnegie and Westinghouse industries and a host of others in and about Pittsburg make this locality probably the most interesting in engineering lines in America. Admission to some of these plants is, under ordinary circumstances, difficult to secure. But strong local committees of influential men will do all that can be done to give visitors entrance wherever desired on the important occasion of the coming meeting. Local conditions, therefore, should make Section D, devoted to 'Mechanical Science and Engineering,' the most prominent of the Association.

It will have the active cooperation of the Engineers' Society of Western Pennsylvania —a powerful organization of 404 members. Prominent investigators in various parts of the country have already signified their intention to participate.

The order for the week will be short, crisp, pithy papers for the morning sessions and carefully planned educational excursions under competent local leadership for the afternoons.

This notice is sent out to engineers everywhere and a cordial invitation is extended to them to send to the secretary as soon as convenient titles and abstracts for the morning programs.

The American Association opens at Pittsburg on Saturday, June 28. On Thursday, Friday and Saturday of the same week the Society for the Promotion of Engineering Education will also meet in the same city. A rare series of meetings is in store, therefore, for those who attend, and it is hoped that very many engineers will put Pittsburg on their summer schedule. Please remember to send titles and abstracts very soon to the secretary.

J. J. FLATHER, *Chairman,*
C. A. WALDO, *Secretary.*

LAFAYETTE, INDIANA.

SECTION A, MATHEMATICS AND ASTRONOMY.

Members of the Association who will have papers to present before Section A at the Pittsburg meeting, June 28–July 3 next, are requested to send the titles of such papers as soon as possible to the Secretary of the Section.

EDWIN S. CRAWLEY.

UNIVERSITY OF PENNSYLVANIA.

CENTRAL CONTROL OF THE EXPERIMENTAL STATIONS.

THE article on the above subject by H. F. Roberts, in a late issue of SCIENCE, urges a point of view in some respects plausible, but not, I think, in accord with the best interests of either the scientific or the practical aspects of the station work; unless it be from the standpoint of the trite saying that the best government would be that of a wise and benevolent despot. And surely, if it is bad for the West to have stations established ten or seventy miles apart, it is worse for the East, where the stations, *e. g.*, of the New England states, and of Delaware, Maryland and New Jersey, are located so closely together within a remarkably uniform climatic region, while similar distances on the Pacific slope will often involve the most startling climatic contrasts. By parity of reasoning, the central authority called for ought to abolish and redistribute a dozen of these stations of the Atlantic coast region; and logically, the abolition of 'Little Rhody' and similarly small states, which are exceeded in area by many single counties in the West, should follow in due course, the political preponderance given them at present being clearly unfair.

Robert's fundamental idea, that stations should be located so as to represent climatic

and soil regions instead of state lines, is undoubtedly correct, and there is no excuse for the close proximity of the Washington and Idaho stations, as there is plenty of elbow-room in both states. The local and political 'pulls' exerted for the location of stations, without reference to fitness, is unquestionably a crying evil. But the same applies to a hundred other subjects of state legislation, including normal schools, asylums of all kinds, and even penitentiaries. The taxpayers' money is wasted in these useless duplications; and all this could be avoided if we had the wise and benevolent despot, who would arrange and handle these matters in accordance with common sense, economy and 'the greatest good to the greatest number.' But, until we find that highly gifted person, we must submit to what is simply a part of the price we have to pay for democratic institutions.

It is, or assuredly should be, one of the main objects of the stations to investigate, first of all, the problems that interest their respective constituencies. The fact that they are partially dependent for their income upon state appropriations is a wholesome admonition to conform to this reasonable expectation; on the other hand, the supervision of the national Department of Agriculture is an equally wholesome restraint upon improper use of their funds. But that Department has not now, and will not have for a long time to come, the intimate knowledge of the entire enormous area of the United States that would be necessary to determine advisedly the best direction to be given to the energies of each of the numerous stations. However well assured we may be of the benevolence of the Department, it has not had the time or means to acquire the wisdom which is the other necessary postulate of the good despot. Those whose work is done thousands of miles away from Washington have reason to know this; *e. g.*, it is only within the last few years that the necessity of having seeds to be tested in California, on hand by the middle of January at the latest (and in many cases by the first of October), has been appreciated and acted upon at the national headquarters, although the present writer had made annual representations to that effect for over twelve years. The usual quadrennial changes in the Secretaryship of Agriculture render the recurrence even of this very infelicity (not to mention others) a contingency far from remote.

To quote the language of the excellent report of the committee on cooperative work between stations and the Department of Agriculture: 'Not only is the autonomy of the stations necessary for the fulfilment of their functions, but autonomy in scientific investigations is essential.' And to quote still farther, a late distinguished visitor from Europe said that 'the danger of republics is corruption; that of monarchies is routine.' The present organization of the stations seems to me to provide against both, as far as is practically feasible. The mislocation of stations will in time cure itself, at the expense of the sinning states, who are bound to keep the federal or 'Hatch fund' intact; and meanwhile there is plenty of work to do for even such stations right where they are. Nay, if we are to take the dicta of some of our eastern station men literally, it should make little difference where they are located, so long as they are to confine themselves to the expansion of the '*science* of agriculture' only. Fortunately, few of the western stations have held this view, and fewer have acted upon it. With a multitude of new practical problems before them, and a constant demand for information involving a knowledge of local conditions in unexplored territory, a policy differing in important points from that of eastern and European stations becomes a necessity; and while the Department at Washington may justly object to having the 'Hatch fund' so subdivided among regional substations as to become inefficient for good work, the need of these substations is nevertheless felt by all workers where, as in a large portion of the West, cultural conditions are more radically different within short distances than is the case anywhere between the Atlantic seaboard and the Mississippi. The state stations are naturally in the best position to know and appreciate these differences, and can most intelligently act upon them; while there is no organized instrumentality whereby the Department at

Washington could acquire such knowledge. Much can be done by cooperation, so long as this does not degenerate into invidious competition; but the autonomy and initiative of the stations are assuredly the best means of maintaining their usefulness to the people of their several states, and to the progress of agricultural science in its widest sense, viz., its application to the actually existing conditions, even though these may appear 'abnormal' to the dwellers in the temperate humid regions where that science has been first developed.

E. W. Hilgard.
University of California,
March 24, 1902.

THE SUBMARINE VALLEYS OF THE CALIFORNIA COAST.

In Science for January 10, Professor Wm. E. Ritter, reporting the dredging work done last summer off the coast of southern California, states that 'the bottom deposits of some, at least,' of the submarine valleys which characterize the California coast, 'even at a distance of several miles from shore, are of a character to prove that close inshore material is carried into them in large quantities.' And to him this 'observation suggests, though of course does not prove, that the valleys are natural channels through which currents flow, at times, at least, from *the shore out to deeper water.*'

On entirely different grounds, the present writer had reached a somewhat similar conclusion—that the majority of the submarine channels of the California coast have been formed, or are at least kept open, by some cause now in operation, and that cause coastal currents. These views and the reasons for them were given by the writer in a paper read before a meeting of some members of the U. S. Geological Survey, about a year ago; they can be only briefly outlined here.

The mature Coast Ranges of California, taken as a whole, lie close to and parallel with the coast line, and the coastal topography is therefore rugged. As the larger stream courses follow the trend of the ranges and the coast for long distances, there are few coastal breaks of importance. Fringing this rugged coast and the coastal islands is a narrow submarine terrace or platform, the 'continental shelf,' which has been formed mainly by marine abrasion, and whose outer margin is marked approximately by the 100-fathom submarine contour. Its width ranges from a minimum of about a mile to a maximum of about thirty-two miles, the average being between five and ten miles. The submarine valleys (of which between twenty-five and thirty have been described along the Pacific coast of California and Lower California) notch this terrace and its outer escarpment. The valleys, for the most part, begin at or near the shore line and continue to depths ranging from about 400 feet to more than 3,000 feet, the majority descending to at least 2,000 feet. Most of the valleys follow a course roughly at right angles to the shore. Their forms are both simple and branched. Some of them head opposite the mouths of large valleys on the land, and some opposite abrupt and rugged portions of the coast, where there is no break in the Coast Ranges. The valleys in general are quite open, none of them being 'chasm,' as is frequently supposed. This may be easily seen in the cross sections of the valleys. While the general slope of their walls differs considerably, in any given case it is comparatively gentle, taken as a whole. Two cases of unusual steepness have an angle of only about 20°, while the maximum angle measured was about 31°, in Cape Mendocino valley. The grade (profile) of the valleys is considerably greater than that of the lower parts of the larger coastal valleys. Vincente valley, from the shore line to a depth of 1,800 feet, has an average grade of about 260 feet to the mile, while the grade for the first quarter-mile from shore is about 720 feet to the mile.

Two explanations of these submarine valleys have been proposed: one that they are structural in origin (Lawson); the other that they are submerged stream valleys (Le Conte, Fairbanks, Davidson).

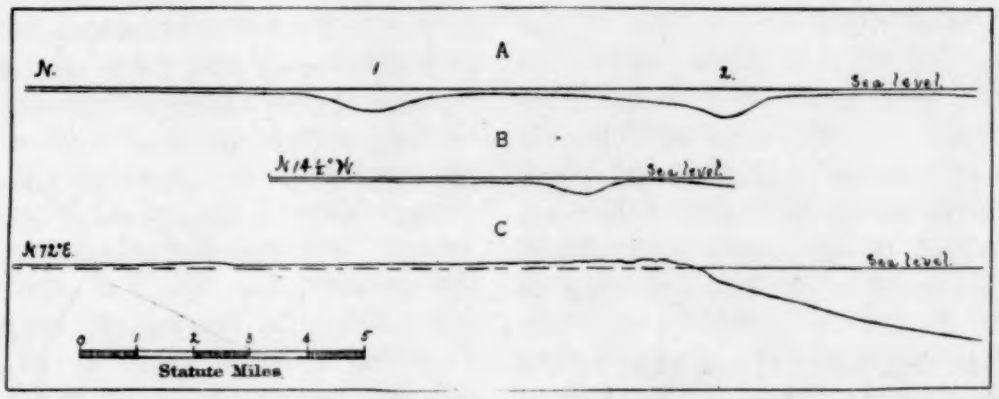
There can be little doubt that *some* of the valleys are due to coastal deformation; but this interpretation is unsatisfactory in accounting for the majority of them, for the following reasons:

(1) Many of the more important valleys *stop abruptly at or near the shore line,* and no corresponding valley or depression exists on the land, so far as known; nor (2) are there, except in a very few instances, corresponding embayments in the coast line, as there should be if the valleys are of comparatively late origin, and especially if developed subsequent to the formation of the 'continental shelf' (submarine platform).

(3) The submarine platform, except in one or two places, shows nothing that could be interpreted as warping in their neighborhood, as it should if they were of subsequent development. (4) On the other hand, unless the valleys belong to the very latest stage of coastal development, the submarine platform should be developed between the head of the valley and the shore, or the head of the valley should be filled with shore detritus. This is not the case with most of the valleys.

(5) The objection raised by Fairbanks that their course is transverse to the principal structural lines of the coast, appears to the present writer to have little weight, since minor structural lines might occur at any angle with the main lines.

The interpretation as submerged stream valleys is also unsatisfactory because: (1) The submarine valleys do not, in general, correspond in position to valley openings on the shore, and, *vice versa,* the coast drainage lines (except in a very few instances) have no corresponding submarine channels. (2) Where they are opposite important valleys on the shore, the submarine valleys do not correspond to them in size, shape or grade. (3) The submarine platform, in the case of many of the more important valleys, has not been developed through cutting between the head of the valley and the shore, nor have the heads of the valleys been filled in with sediments, even in regions of deposition. Two of the valleys head near the points of cuspate forelands, the valleys, in both instances, running in close to the beach. A third valley



A. Section across (1) Cape Mendocino and (2) Punta Corda submarine valleys, where the valley bottom of the former has a depth of 2,000 feet, and of the latter a depth of 2,400 feet.

B. Section across Vincente submarine valley, where the valley bottom has a depth of 1,500 feet.

C. Profile of Vincente submarine valley and of the mainland along the same general line. Vertical scale in *C* five times horizontal.

heads near a form having the general appearance of a blunt cusp. If the submarine valleys were developed prior to the formation of the platform, they would have been modified by its development; if subsequently developed (as stream valleys), it should be possible to trace them inland, and there should be corresponding embayments in the coast line.

In view of the fact that so many of the valleys (about one-half) stop abruptly close to the present shore line, it would hardly seem that this could be accidental, and the reason for it is the critical point in attempting an explanation of the valleys. This fact, together with the other objections given above, would point to the conclusion that some of the valleys at least must be wholly or partly due to present causes. The only cause capable of producing such results—keeping the valley head open close to shore in the face of active

cutting or deposition—would seem to be coastal currents of some sort. Such currents must be either marine, or else subterranean streams from the land, and it does not seem altogether unlikely that they might be the latter. The emergence of subterranean streams might at least account, in some cases, for the absence of deposits in the valley heads and their nearness to the shore, if not for the formation of the valley as a whole. The occurrence of an oil well in Vincente valley near its head is significant in this connection. The larger pre-Pliocene valleys of the Pacific coast, which were much deeper than those of the present time, were filled to a greater or less extent during the Pliocene depression of the coast, and have been as yet only partially re-excavated. There are therefore at intervals along the coast, deposits of loose materials extending to a considerable depth below sea level, and through these, underground waters, under sufficient head, might find a submarine outlet.

It is possible that many if not most of the valleys are due, not to any one cause, but to several causes which have all contributed to their formation or preservation. Much careful and detailed investigation is necessary before the problem can be solved, and the statements made here are intended as suggestive rather than final. Such work as Professor Ritter reports gives valuable information. Observations in the vicinity of the valleys on surface currents, their strength, direction and persistence, and on the temperature and salinity of the surface waters, and also similar observations made, as far as possible, near the bottoms of the valleys and in their neighborhood, as well as a study of the materials covering their floors, might throw much light on the question of their origin. Further than this, detailed geological study of the mainland adjacent to the valleys is necessary. The physiographic conditions, both subaerial and submarine, have been taken into account, to a certain extent, in this discussion, but a fuller knowledge of them is needed. Finally, as has been stated elsewhere by the writer, each valley must be considered by itself, since the explanation for any one is not necessarily the explanation for all.

W. S. Tangier Smith.

Washington, D. C.

SHORTER ARTICLES.

How many one-dollar bills will equal in weight a five-dollar gold piece?

If the reader will answer the above question in his own mind before going further he will better appreciate what follows. This question was asked of a number of students and professors, and the answers recorded. The answers were surprising and for the most part extravagant. It seems that the idea of value is so prominently associated with currency that definite ideas of weight are somewhat wanting, although most people have fairly correct ideas of the weight of paper in other forms. The number of persons answering the question was 97. The average estimate was 2,291 bills, the median estimate was 45. In order to see if there is any tendency to confuse the categories of value and weight unconsciously, other persons were asked to answer the question: How many five-dollar bills will equal in weight a five-dollar gold piece? Some were asked a similar question with reference to twenty-dollar bills. Putting the fives and twenties together, there were 74 answers given. The average estimate was 97, the median 25. The great difference in the averages is due to a half dozen very large answers to the first question, but these do not materially affect the median estimates, which are the really significant figures. The answers are all from males. A number of answers were given by female students, but their answers, either by chance or by nature, were of such a great variety—ranging from one to one million—that it seemed best to leave them out in making the comparison. After these calculations were made I received answers, through the kindness of Professor Templin, of the University of Kansas, from two divisions of a class of both sexes. The figures with reference to the one-dollar bills show an average of 2,749, and a median estimate of 99, while with the five-dollar bills the

average was 492, and the median 50. It is interesting to note that the ratio of the median estimates in the two sets is approximately the same. The number of bills actually required is a little less than seven.

J. FRANKLIN MESSENGER.
COLUMBIA UNIVERSITY.

RECENT PROGRESS IN PETROLOGY.

CHEMICAL CLASSIFICATION OF ERUPTIVE ROCKS.

OSANN, in a recent paper (Tschermak's *Min. u. petrographische Mitth.*, Bd. XX., pp. 399–588, 1901), has carried out with reference to the effusive rocks the principles of classification which in an earlier publication (*Ibid.*, Bd. XIX., pp. 351–470, 1900) he applied to the plutonic rocks. It is his avowed intention to discuss in a third contribution the application of the same principles to the dike rocks.

The chemical compositions of the rocks are expressed by the general formula

$$s_v a_w c_x f\, n_z$$

where

s = the molecule SiO_2.

a = the atomic group $(NaK)_2Al_2O_4$.

c = the atomic group $CaAl_2O_4$.

f = the atomic group $(FeMnMgSrBaCa)O$.

n = the proportion of soda molecules when the relative numbers of soda and potash molecules in the rock are calculated to a sum of 10.

v = the number of molecules of silica when the ordinary molecular ratios of the rock analysis are calculated to a sum of 100.

w, x and y = the proportions of each of their respective atomic groups, when all three are calculated to a sum of 20.

z = the numerical value of the soda proportion n.

In these two papers 207 analyses of plutonic and 403 analyses of effusive rocks are considered and the corresponding rock formulas calculated. From these formulas the rocks are plotted upon triangular projection paper, the elements of the projection being *a*, *c* and *f*.

The carrying out of this plan has involved much labor, and if the result is somewhat disappointing it has at least the full value of recording a careful and sustained experiment. It is to be regretted that the author has modestly restricted his attempt at classification to setting up types within the groups and families of the Rosenbusch classification. It is partly owing to this acceptance of a scheme which has grave objections and which is based on principles little in common with those on trial in this essay, that the latter falls short of more conclusive results. For example, it is seen that the formula of the 'Klausen type' of the diorites is identical with that of a granite intermediate between the 'Syene type' and 'Kamm type,' and similar cases are found among the formulas of the basaltic andesitic and allied rocks of the effusives.

Inspection of the diagrams fails to show any grouping of the effusive rocks upon which classification might be based. In the plutonic rocks the anorthosites alone show some tendency in the graphic projection to form a distinct family. The silica does not appear in the method of plotting here used, and the result is hardly so graphic and satisfactory as that employed by Brogger in his 'Ganggefolge des Laurdalits.'

GNEISSES OF THE SCHWARZWALD.

IN continuation of his studies of the crystalline metamorphic rocks of Baden, Rosenbusch (*Mitth. der Grossh. Badischen Geologischen Landesanstalt*, IV., pp. 367–395, 1901) gives detailed petrographical descriptions and chemical analyses of the para-augite and para-amphibole gneisses of the Schwarzwald, the prefix *para* signifying their derivation from former sediments. The augitic gneisses range from quartzose or psamitic types, to those free from quartz. It is concluded on chemical grounds, supported by geological relationships, that these gneisses have been formed by the metamorphism of calcareous sandstones, dolomitic calcareous shales and clayey marls. The hornblendic gneisses were derived from a ferruginous dolomitic marl containing quartz and rutile.

These interesting studies, which recall those

of Adams on the Grenville Series of Canada, constitute a substantial step toward a more precise knowledge of the real nature and origin of the Archæan complex. The need of modern analyses of typical unaltered sediments for purposes of comparison with crystalline metamorphic rocks in these and similar investigations is rendered apparent.

SEQUENCE OF VOLCANIC ROCKS.

In a paper by Lawson and Palache on the Berkeley Hills, California (*Bull. of the Dept. of Geology,* Univ. of Calif., Vol. 2, pp. 349–450, 1902), the microscopical petrography of a series of andesitic, basaltic and rhyolitic lavas is described in detail. The most interesting petrological feature brought out in their description, however, is the remarkable fivefold repetition of the eruption of andesite, basalt and rhyolite, in the order named. As the authors cautiously point out, the small size of the area considered (less than six square miles) renders it possible that the perfection of this periodicity is accidental, but this commendable reserve does not deprive the fact of its importance and significance. The paper, as a whole, is a successful attempt to present to students a detail of the remarkably rich geological field which surrounds the University of California.

F. L. Ransome.

THE ALASKA FUEL SUPPLY.

In closing his discussion of the coal resources of Alaska, in Part III. of the Twenty-second Annual Report of the United States Geological Survey, now in press, Mr. Alfred H. Brooks adds some brief comments on the other sources of fuel. In addition to coal, he says, there are three possible sources of fuel supply in Alaska, namely, timber, petroleum, and peat; and of these, timber alone has been utilized. Southeastern Alaska is heavily forested and affords ample wood for fuel. Certain species of trees are found as far west as Kadiak Island. Beyond Kadiak, to the west and north, the coast-region of Alaska is practically treeless. Some willows, and occasionally spruce, are found in the sheltered regions; but for the most part the coastal belt is covered simply with moss, grass and low shrubs. This type of vegetation extends northward to Point Barrow and thence eastward. The moss and grass-covered plains and the rolling plains are called *tundras,* and are found on the northern continental margins encircling the globe.

The interior of Alaska has usually a sufficient supply of wood for ordinary purposes of building and mining and for fuel. The larger river valleys are often heavily forested with spruce and other trees. On the Yukon, near the international boundary, the timber line is at about 3,000 feet; northward it decreases in elevation, and on the Koyukuk it is about 2,500 feet. Still further to the north and west it further decreases in altitude, and on the Upper Kobuk the timber is said to be limited to the floor of the largest river valleys. In the northern Arctic drainage reports state that there is no timber except the willows, which however grow to considerable size. The Kuskokwim, Sushitna and Copper rivers all have timber basins. During the great influx of population of the last three years, much timber has been destroyed by fire in the dry summer months. In the northwestern and northern parts of the territory, from Norton Bay around to the mouth of the McKenzie, the shore was once abundantly supplied with driftwood. The Eskimos, who have been using this wood for generations, are very economical in the matter of fuel, and, until the coming of the white man, the probabilities are that the driftwood was accumulated faster than it was used. This driftwood is brought down from the interior by the larger rivers, whose banks are wooded. The cutting of the wood along the banks of the Yukon has already decreased the annual contribution of driftwood to northern Bering Sea. This, together with the rapid exhaustion by the white man of the supply which had accumulated in the past, will soon cause the Eskimo as well as the white man to be dependent on other sources for fuel. The North Arctic Coast eastward from Point Barrow, which is but thinly populated by natives and seldom visited by whites, has some driftwood. The possibilities of using for fuel the thick growth of vegetable matter which covers most of the

treeless regions of Alaska have been suggested, but have never been put to practical test. During the months of June and July, 1900, extensive fires swept through much of the treeless region of Nome and other portions of the Seward Peninsula. The moss and grass, when dry, were found to burn rapidly with considerable flame, and fires ran over nearly the entire region visited by prospectors during the dry months. This fact makes it evident that the surface growth of the tundra could be used for fuel, provided it were properly dried. This material has in many cases been accumulated to considerable thickness in peat bogs. With regard to the third source of fuel supply, petroleum, we have no definite knowledge of its existence in commercial quantities. It is reported to have been found in southeastern Alaska, between Yakutat and Controller bays, south of Mount St. Elias, and also on the east side of Cook Inlet near Kachemak Bay.

CRUISE OF THE ALBATROSS.

THE Fish Commission steamer *Albatross*, which sailed from San Francisco on March 11, arrived at Honolulu on March 24, as noted in SCIENCE of April 11. Heavy weather was encountered almost immediately after leaving port, and on the 12th the quartermaster of the watch was lost overboard while taking the reading of the patent log. Much interesting pelagic material was obtained with surface and intermediate nets on the outward voyage. An attempt, extending over two days, to determine the nature of the life on Erben Bank was unsuccessful, as the peculiar laval formation of the bottom resulted in the loss of all the trawls and other appliances used and subjected the dredging cable to an unprecedented strain.

The surface collecting off Waikiki on March 27 by the aid of electric light is reported by Dr. Gilbert to have been probably the most successful work of the kind ever done. Among the creatures thus obtained is a remarkable animal, first identified as a crustacean, afterwards called a worm, and finally considered a vertebrate; its eyes are on stalks half an inch long.

SCIENTIFIC NOTES AND NEWS.

DR. DANIEL COIT GILMAN, president of the Carnegie Institution, sailed for Europe on April 17, with a view to studying foreign scientific institutions.

PROFESSOR WILLIAM JAMES is at present abroad, in order to give his second course of Gifford lectures at Edinburgh. Dr. Gwatkin, professor of ecclesiastical history in the University of Cambridge, has been appointed to succeed Professor James as Gifford lecturer.

PROFESSOR SOLON I. BAILEY, of the Harvard Astronomical Observatory, is about to leave for the observatory's branch at Arequipa, Peru, where he will especially study the planet Eros.

DR. W. H. R. RIVERS, of Cambridge University, will shortly start on an expedition for the psychological study of the Todas of southern India on the lines of his work in Torres Straits.

M. T. OBALSKI has been sent by the French Government and the Paris Museum of Natural History to Canada to make collections and study the natural history and industries of the country.

PROFESSOR FRANZ SOXHLET, of the Munich technical school and director of the agricultural experimental station, has been made chevalier of the Order of Merit of the Bavarian Crown.

A VOLUME has been published commemorating the jubilee celebration in honor of M. Berthelot, held on the twenty-fourth of November last. Copies of the plaque struck in his honor have been presented to all members of the French parliament.

WE noted in our last issue that Professor Keen, of Philadelphia, had been made an honorary member of the German Surgical Association at its thirty-first Congress. The other honorary members were Professors Bergmann and König, of Berlin, Professor Guyon, of Paris, Professor Durante, of Rome, and Professor MacEwen, of Glasgow.

JOSEPH J. KINYOUN, M.D., Ph.D., late surgeon of the Marine Hospital Service and director of the Hygienic Laboratory at Wash-

ington, assumed the directorship of the biological laboratories of the H. K. Mulford Company at Glenolden, Pa.

It is planned to found at Edinburgh University a laboratory in memory of the late Professor Tait. A subscription of £1,000 has been received.

Professor Hans Büchner, the eminent bacteriologist, died at Munich on April 5, in the fifty-second year of his age.

The following amendments to the Sundry Civil Appropriation Bill have been proposed in the Senate: An amendment proposing to appropriate $5,000 for the preparation of preliminary plans for an additional fireproof building to cost not exceeding $2,500,000 for the United States National Museum; an amendment proposing to increase the appropriation for the expenses of the system of international exchanges between the United States and foreign countries, under the direction of the Smithsonian Institution, from $24,000 to $29,800; an amendment proposing to increase the appropriation for continuing the preservation, exhibition, and increase of the collections in the National Museum from the surveying and exploring expeditions of the Government from $180,000 to $200,000; an amendment proposing to increase the appropriation for the National Zoological Park at Washington, D. C., from $80,000 to $110,000, and providing that $20,000 of this amount shall be expended in the construction of a boundary fence, including entrance gates; an amendment proposing to appropriate $20,000 for the construction of an elephant house at the National Zoological Park, Washington, D. C.; and an amendment proposing to appropriate $25,000 for the construction of an aquarium building at the National Zoological Park, Washington, D. C.

The U. S. Civil Service Commission announces an examination on May 15, for the positions of botanist in charge of grain investigations and of assistant curator in the Bureau of Plant Industry. The salary of each position is $1,800. An examination will also be held on May 6 and 7 for the position of field assistant in forestry in the Bureau of Forestry at a salary of $1,000.

The executive committee of the Carnegie Institution held a meeting at Washington on April 15.

Professor W. R. Brooks, director of the Smith Observatory at Geneva, N. Y., announces the discovery of a comet in the constellation Pegasus. The comet has been observed at the Lick and Kiel Observatories.

Professor von Leyden claimed before the German research committee on cancer, at Berlin, on March 21, the discovery of the microorganism of cancer. He concluded by the assertion that 'cancer is an infectious disease, dependent on parasitic organisms (protozoa) identical with those discovered by him and exhibited to the meeting.'

The board of estimate of New York City has authorized the issue of bonds for public improvements giving $250,000 to the Zoological Park and $150,000 to the Botanical Garden.

Mr. Andrew Carnegie has made the Public Library Board of Cincinnati an offer of $180,000 with which to erect six new branch library buildings in different parts of the city. He stipulates that the Board shall supply $18,000 a year for the maintenance of the proposed branches.

Dr. V. Guaita has given 15,000 Marks to the University at Freiburg for a fund to aid in supporting scientific expeditions.

As we learn from the *British Medical Journal*, the Prussian Government has voted 26,000 Marks for lecture courses in hygiene, forensic medicine, and psychiatrics which are to be held in Berlin for the benefit of the district health officers. Professor Koch and his assistants will take charge of the hygiene course (chief stress to be laid on the prevention of epidemics); Professors Jolly and Moeli will undertake psychiatrics, the former in his department at the Charité, the latter in the Herzberge Asylum. The courses are to be gratis, and the hearers will receive a fixed sum for traveling and lodging expenses. If these courses should prove as successful and useful as is hoped, they are to be repeated, and may grow into a permanent institution.

As announced last year, the association for maintaining the American women's table at

the Zoological Station at Naples and for promoting scientific research by women offers a prize of one thousand dollars for the best thesis, written by a woman, on a scientific subject presented before December 31, 1902. A second prize of one thousand dollars is now announced by the same association. The theses offered in competition are to embody new observations and conclusions based on independent laboratory research in biological, chemical or physical science, and are to be in the hands of the chairman of the prize committee, Mrs. Ellen H. Richards, Massachusetts Institute of Technology, Boston, Mass., before December 31, 1904.

WE regret to learn that the Mayor of San Francisco has removed the Board of Health of that city on the alleged ground that their report of the presence of the bubonic plague in that city was incorrect.

THE *British Medical Journal* states that the Congress of the Association of French and Foreign Anatomists opened at Montpellier on March 24, under the presidency of M. Sabatier, dean of the faculty of science. About sixty delegates from various parts of France and from Switzerland, Belgium, Spain, Italy and Germany took part in the proceedings. A number of interesting papers were read. The principal feature of the Congress seemed to be a desire to establish a closer union between anatomy and physiology, between the study of the structure of an organ and its function.

ARRANGEMENTS have been made for a nature study exhibition to be held at the gardens of the Royal Botanic Society, London, on July 23 and following days. It will be open to colleges and schools of every grade, and the exhibits will include all that bears upon nature study. Various technical institutions and other educational authorities have arranged to defray the cost of the conveyance to exhibits from their respective areas, and preliminary exhibitions for the purpose of selecting the best material to send are being organized.

THE valuable medical library of the late Professor von Ziemssen, containing twenty-five thousand boods and pamphlets, has been purchased by the Leipzig bookseller, Gustav Fock. It would be an advantage if the library could be secured for an American institution.

A DESPATCH to the New York *Herald* from Montevideo says that news has been received from the Swedish Antarctic expedition under Dr. Otto Nordensjöld. The expedition has disembarked at Snow Hill, Louis Philippe Land, accompanied by the surgeon, Dr. Eklof, the Argentine Lieutenant Sobral and two sailors, one of whom was a member of the Duke of Abruzzi's Arctic expedition. From Cape Horn Dr. Nordenskjöld's vessel, the *Antarctic,* tried to sail directly south, but it enoountered too many icebergs, and there was danger of the ship being imprisoned in the ice for a long time. Dr. Nordensjöld then decided to change his course. His expedition will remain at Snow Hill until next summer.

M. ADRIEN DE GERLACHE, the Belgian navigator whose expedition to the south Antarctic five years ago will be remembered, is contemplating another voyage on a more extensive scale. M. de Gerlache hopes to leave one of the French ports in September of next year, when a vessel will be fitted out at the expense of a French capitalist.

THE auxiliary barque-rigged yacht, *Morning,* which is now being fitted out under the direction of Sir Clements R. Markham, president of the Royal Geographical Society, for the Antarctic Relief Expedition, will sail under the flag of the Royal Corinthian Yatch Club, and will lie off the club-house at Port Victoria until ready to start.

THE New York Botanical Garden announces the spring lectures for 1902, to be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at 4:30 o'clock, as follows:

April 19, 'The Maples and other Early-flowering Trees': CORNELIUS VAN BRUNT.

April 26, 'Plant Life of the Sea': Dr. MARSHALL A. HOWE.

May 3, 'Botanical Features of Porto Rico': Professor L. M. UNDERWOOD.

May 10, 'Some Examples of Botany in its Relation to Geology': Dr. ARTHUR HOLLICK.

May 17, 'Wild Flowers, the Necessity for their Preservation': Mr. CORNELIUS VAN BRUNT.

May 24, 'The Cottons': Dr. H. H. RUSBY.

May 31, 'Cactuses and Cactus-like Plants': Dr. N. L. Britton.

June 7, 'Favorite Flowers of Nations and Poets': Professor E. S. Burgess.

June 14, 'The Vegetation of American Deserts': Dr. D. T. Macdougal.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5:38 train from the Bronx Park railway station, arriving at Grand Central Station at 6:04.

The Rome Correspondent of the London *Times* reports that Signor Boni, director of Excavations in the Roman Forum, has made another discovery of unusual interest. It has long been his conviction that the subsoil of a part of the Forum contains the necropolis of the founders of Rome and that, given the Aryan origin of those founders, the character of the tombs must be in accordance with the Aryan custom of cremation. Critics have displayed much scepticism concerning this theory, as also concerning the traces of Aryan development which Signor Boni has detected in the Forum; but he has once more silenced their objections by producing the object whose existence they had doubted or denied. He has discovered a prehistoric tomb, believed to date approximately from the eighth century B.C., containing a large urn, or *dolium*, of black ware full of calcined bones, and several reticulated egg-shaped vases, besides a bowl and a cup with horned handles like those found in the *terremare* of the bronze age. The tomb is situated in the bed-clay some twelve feet below the level of the Sacred Way, opposite the Regia, and close by the Temple of Antoninus and Faustina. In some respects this discovery is the most important yet made in the Forum. One tomb is not a necropolis, but it is presumptive evidence of the existence of others. Unless the Italian Government should, to its shame, restrict the funds necessary for the exploration of the lower *strata* of the Forum, the point will soon be settled. Meanwhile, it is to be noted that the reticulated vases of the tomb bear a striking resemblance to netted gourds, and that the covering of the funeral urn is a faithful reproduction of a conical hut roof—signs that they date from a primitive period. The tomb may be regarded as the extreme link in the further end of the chain of Roman history, as reflected in the Forum and illustrated by Signor Boni in the discoveries of the *cippus* under the Black Stone, the Rostra, the ritual pits, the massive Republican drains (beside which the Cloaca Maxima seems insignificant), the extraordinary underground gallery for scene-shifting, the Lacus and the Fons Juturnæ, the Sacred Way, the Heroon of Cæsar, the Regia, the house of the Vestals, the Basilica Æmilia, and the Church of Santa Maria Antiqua—to enumerate only the more important of his astonishing results.

The London *Times* states that the Lightning Research Committee, which was organized in January, 1901, by the Royal Institute of British Architects and the Surveyors' Institution for the purpose of obtaining accurate records of the action of lightning strokes on buildings, with a view to improving if possible the means of protection, has enlisted the services of over 200 competent observers in the United Kingdom, besides a considerable number in the colonies and India and in foreign countries. The War Office, the Home Office, the Post Office, the Trinity House Corporation and the United States Department of Agriculture have signified their willingness to furnish the committee with the required particulars of damage to buildings under their control resulting from lightning stroke. The heavy thunderstorms of last year afforded numerous opportunities of investigating and recording, upon lines laid down by the committee, the damage caused by lightning to buildings within their area of observation. The net result so far is a series of some 70 or more trustworthy records, which furnish promising material for the committee to work upon when sufficient *data* have been collected to enable them to formulate their conclusions. The committee make a point of getting photographs immediately after the occurrence of a disaster in cases of importance. Out of 60 cases tabulated by the committee up to the end of December, 1901, no fewer than 12 relate to buildings fitted with some form of lightning conductor. As regards the system recommended by the Lightning Rod Conference of

1882,' *data* to hand are not at present complete enough to afford a practical test of its efficacy. The recently issued report, however, of His Majesty's inspectors of explosives goes to show that the system has been found wanting, and that there is ample justification for the present inquiry. Besides the grants made by the Institute and the Surveyors' Institution, the committee has been aided financially by the government grant committee of the Royal Society and by the Royal Meteorological Society. Valuable help has also been given by the Royal Institute of British Architects, the Surveyors' Institution, the Institute of Electrical Engineers and the Royal Meteorological Society by circularizing their members with a view to getting observers. The committee is constituted as follows: Mr. John Slater, chairman; Major-General E. R. Festing, C.B., F.R.S., Mr. J. Gavey, M.I.C.E., General Post Office; Mr. W. P. Goulding, F.R.G.S., F.S.I., Dr. Oliver Lodge, Birmingham University; Mr. W. N. Shaw, F.R.S., Mr. H. Heathcote Statham, Mr. A. R. Stenning, F.S.I., Mr. Arthur Vernon, F.S.I., Mr. Killingworth Hedges, M.I.C.E., hon. secretary.

THE Secretary of Agriculture has drawn up at the request of the Senate a report on the extinction of the American bison, in which he says: (1) The American bison is on the verge of extermination. Scarcely a handful now remain of the millions which formerly roamed over the plains of the West. (2) So far as the department is aware only two small herds of wild buffalo are in existence in the United States * * * one in the Yellowstone Park, the other in Lost Park, Colo. During the past autumn several of the latter were killed, and while the department has no recent information as to the exact number of animals in these herds at the present time, it has reason to believe that the Yellowstone herd does not exceed 25 and the Lost Park herd eight or ten individuals. (3) There are no wild buffalo in Canada, except in the Peace river country, where a few woodland buffalo, believed to be a different species from our plains buffalo, still exist. (4) A number of buffalo have been domesticated and half-domesticated. In addition to the small herds in zoological parks and in the hands of private individuals there are three important herds—the Corbin herd on the game preserve of the Blue Mountain Forest Association in New Hampshire, the Allard herd on the Flathead Indian reservation in Montana, and the Goodnight herd (containing about a hundred cross-breeds) at Goodnight, Tex. (5) Both the Allard and Goodnight herds consist in part of cross-breeds known as 'cataloes' obtained by crossing buffalo bulls with domesticated cows. Mr. C. J. Jones, the originator of this breed, states that he has succeeded in crossing the buffalo with almost all the different breeds of cattle, but that he considers the Galloway and the Polled Angus the best for this purpose. (6) Recent information indicates that the Allard herd is being broken. Thirty-five animals were sold last year, and a number of others within the past few months. If the government could acquire possession of these buffaloes they might be placed on some reservation under competent management, and if properly protected could be preserved indefinitely. Unless this is done there is little or no hope of maintaining the herd in its entirety. So far as known the Goodnight herd is not for sale, but a proposition has several times been presented to Congress regarding the reservation of certain public lands in New Mexico for their preservation. Under proper restrictions this plan might result in the perpetuation of the herd for some years. (7) Should the government acquire possession of a considerable number of full-blooded animals, it is possible that the absolute extermination of the species might be long delayed. To avoid danger of destruction by epidemic disease and deterioration by too close inbreeding, the government herd should be divided and kept in at least two widely separated localities. This would admit of interchange of blood when necessary.

UNIVERSITY AND EDUCATIONAL NEWS.

THE General Assembly of the State of Iowa has passed a mill tax for the building support of the three educational institutions of Iowa, as follows: State University at Iowa City, one fifth of a mill to run for five years. This will

realize $550,000. The Iowa State College of Agriculture and Mechanic Arts at Ames, one fifth of a mill for a similar period, which will realize $550,000. The State Normal School at Cedar Falls, one tenth of a mill for five years, which will realize $225,000. The state educational institutions receive in addition $434,269 for the biennial period, distributed as follows: State University, $215,000; Iowa State College of Agriculture and Mechanic Arts, $135,000—of this $35,000 is for additional general support annually, and $10,000 annually for the experiment station, $5,000 for live stock, $5,000 to begin the building of a barn and $35,000 to start a main central building; the Iowa State Normal School, $84,269. Other laws passed affecting science and school matters is a compulsory school attendance law; increasing the pages of the report of the Iowa Academy of Science, and paying for illustration in the same and other state papers and reports.

President Raymond has announced that Mr. Andrew Carnegie had given $40,000 to Union College for the completion of Nott Memorial Hall.

The Wilson Memorial Fund for Washington and Lee University has just been completed. The amount is $100,000, and is for the support of the Department of Economics, which was developed through the efforts of President Wm. L. Wilson. For the present the excess of income above the salary of the professor of economics will be allowed to accumulate, until with subsequent gifts it amounts to $25,000, when a memorial building will be erected.

The New Jersey Legislature has appropriated $12,000 for the establishment of a course in ceramics at Rutgers College. The institution has also received a gift of $20,000 from ex-Governor F. M. Vorhees and Mr. Ralph Vorhees.

The Lowell Textile School has received a gift of $21,000 from Miss Charlotte Kitson and Mrs. Emma Stott, daughters of the late Richard Kitson, founder of the Kitson Machine Company. The money is to be devoted to the construction of a spinning building, 275 by 60 feet, adjacent to the group of buildings already under construction, and to be ready for occupancy next September.

Mr. George Westinghouse, of Pittsburg, has made known his intention to present to St. Paul's School, in Concord, N. H., a new building to be used as a physical and chemical laboratory. Plans are now being drawn and a location has been decided upon nearly opposite the new Sheldon library building.

In order that officers of the medical corps of the navy may continue their professional studies, Secretary Long has, upon the recommendation of Surgeon General Rixey, proposed to Secretary Root the establishment of a joint Army and Navy College. That officers may be available for study as well as for duty the secretary has also asked Congress for a slight increase of the medical corps.

Mr. W. W. Astor has given £20,000 to the University of London for the endowment of professorships. This gift is in answer to an appeal by Lord Reay, president of the College, who asked for £700,000 for the endowment of existing chairs and the foundation of new professorships.

By the will of the late Mr. Robert Irvine, of Edinburgh, a chair of bacteriology is endowed in the University of Edinburgh.

Bowdoin College will celebrate its hundredth anniversary at the approaching commencement.

The Rev. Henry Hopkins will be installed as president of Williams College on June 24.

Miss E. E. Carlisle, who has had charge of the work in pedagogy at Wellesley College, has resigned to become one of the supervisors of the Boston schools.

Dr. S. Schlechter, the eminent Talmudic scholar, has accepted the presidency of the Jewish Theological Seminary, and arrived last week in New York to assume the duties of the office.

The Geological and Mineralogical Laboratory at Freiburg has been divided, Professor Steinmann being made director of the Geological Laboratory and Professor Gräff director of the Mineralogical Laboratory.